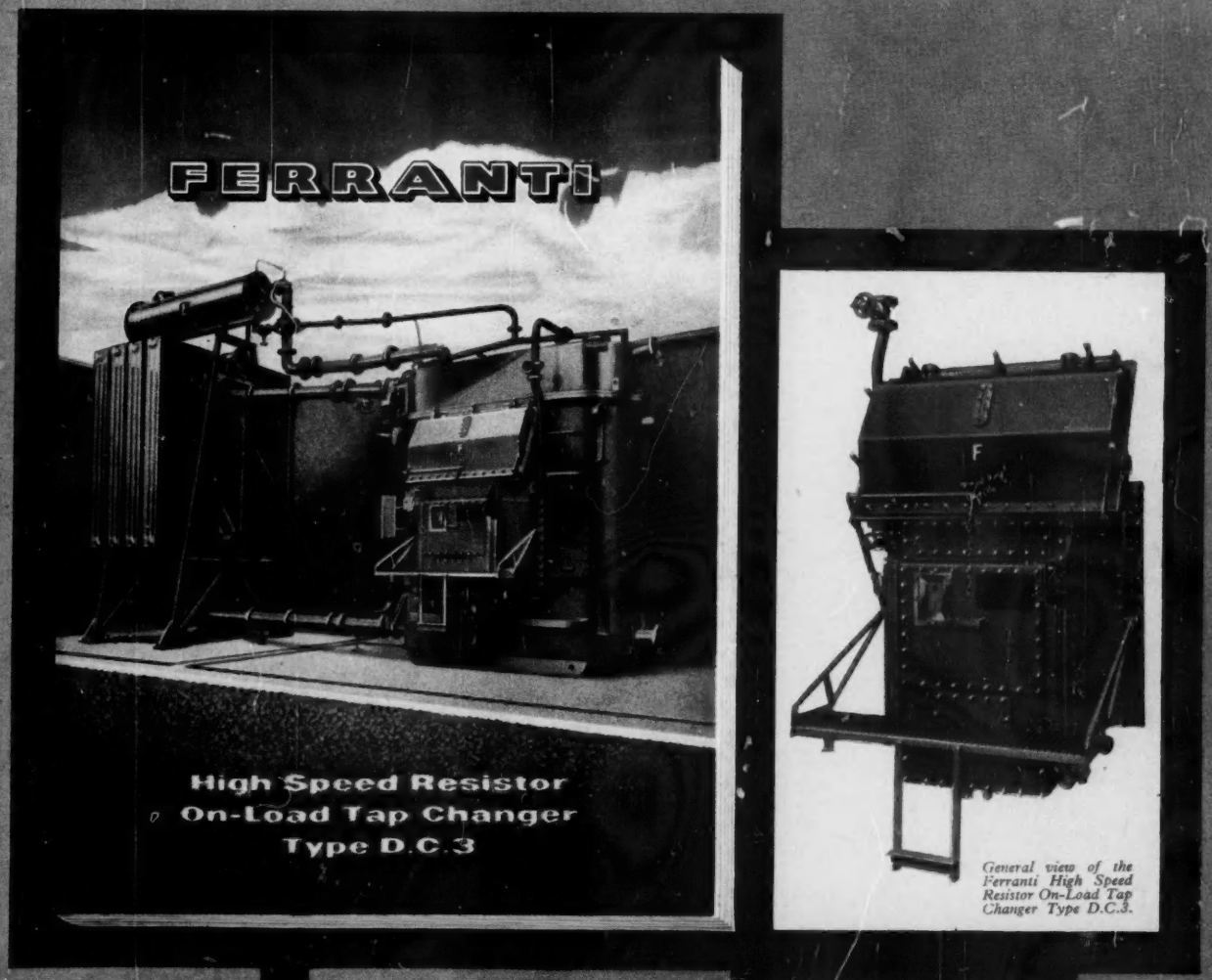
7 JULY 1960

ONE SHILLING AND SIXPENCE

ELECTRICAL TIMES



General view of the Ferranti High Speed Resistor On-Load Tap Changer Type D.C.3.

Write for this Brochure

Ferranti

FERRANTI LTD · HOLLINWOOD · LANCASHIRE Tel: FAllsworth 2000.
London Office: KERN HOUSE · 36 KINGSWAY · W.C.2. Telephone: TEMple Bar 6666.

POWER AND CONTROL

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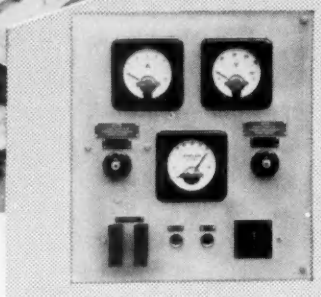

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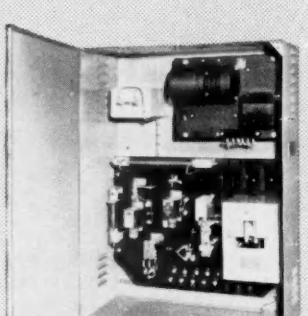

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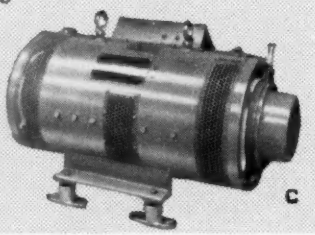

C

E.D.C.C. Stand by at B.B.C. Television Centre, London

In the event of mains failures E.D.C.C. equipment will maintain essential A.C. power supplies to the television programme equipment bays. This is just one example of custom-built special purpose equipment by E.D.C.C.

a Remote control panel in the studio control room.
b Main control panel with automatic starting and voltage regulation.
c Motor alternator set specially constructed to run silently and vibration free. Speed controlled to provide ± 1% frequency constant, irrespective of the battery terminal voltage and load.

E.D.C.C. are manufacturers of:

Dynamometers	HF alternators
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Flame-proof marine motors	Rotary transformers
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CONSTRUCTION COMPANY LIMITED

ST. MARY CRAY ORPINGTON KENT TELEPHONE: ORPINGTON 27551 TELEGRAMS: ELEDAMIC ST. MARY CRAY

Control Gear Division: Bridgwater Somerset Telephone: Bridgwater 2882 Glasgow Office: 40 Houldsworth St C3 Telephone: Central 2620

PS253

Walsall

MINIATURE CIRCUIT BREAKERS & ISOLATING SWITCHES

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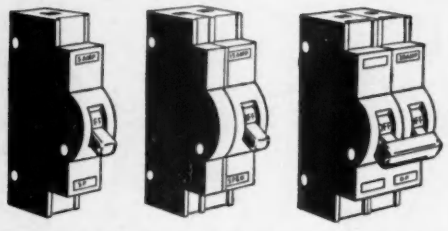

An entirely new and comprehensive range, adaptable to most industrial, commercial and domestic conditions.

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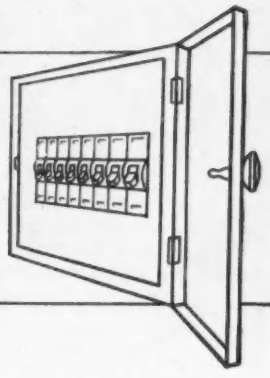
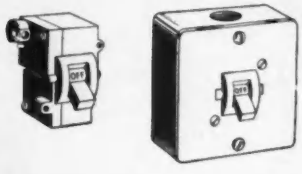


SERIES W



A range of units designed especially to fit the Standard B.S.S. 1299 Box.

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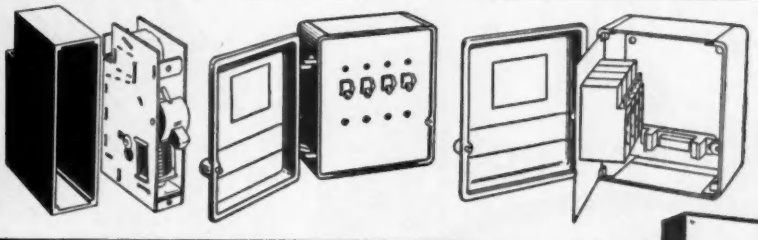

Single Pole units designed for distribution board assembly.

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Every day more and more demands are made upon electrical power and this ever-increasing flow necessitates greater control and protection. The most reliable method of achieving this is by the use of "WALSALL" MINIATURE CIRCUIT BREAKERS to replace conventional fuse units. **The MINIATURE CIRCUIT BREAKER is a circuit control switch and protective device combined.**

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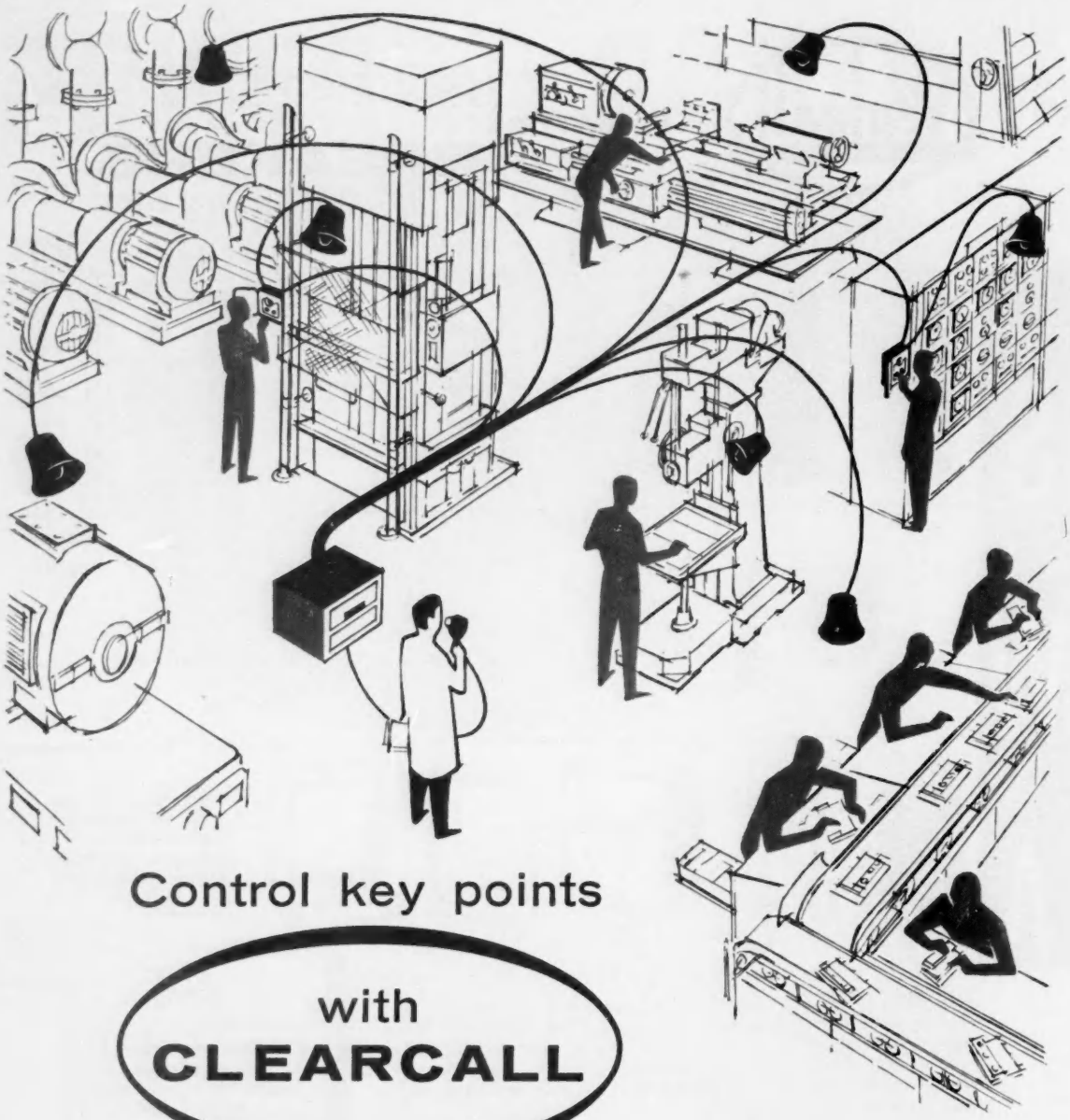

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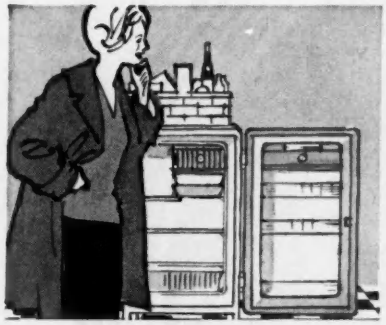
More families choose Electrolux than any other make of refrigerator. Why? Because there's over thirty years' experience in the way the Electrolux is designed.

Because there's proven reliability and solid value behind the remarkably low price. In the L.37 you have a superb Electrolux refrigerator for only £61.5.9.



ROOM TO SPARE The L.37 is designed to fit gracefully into the kitchen. It is the ideal family refrigerator, giving ample space plus the many extra touches so typical of Electrolux value.

SPACE AND LUXURY 7¼ sq. ft. shelf area, full width vegetable drawer, big frozen food compartment, 2 ice trays, butter and cheese store in the door, spacious door shelves—the L.37 gives space and luxury combined.

LASTING VALUE Every penny spent on Electrolux is repaid in lasting value. Electrolux reliability is famous the world over. The L.37 is Britain's most popular refrigerator—a truly sensible family investment.

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Cooling unit guaranteed 5 years.

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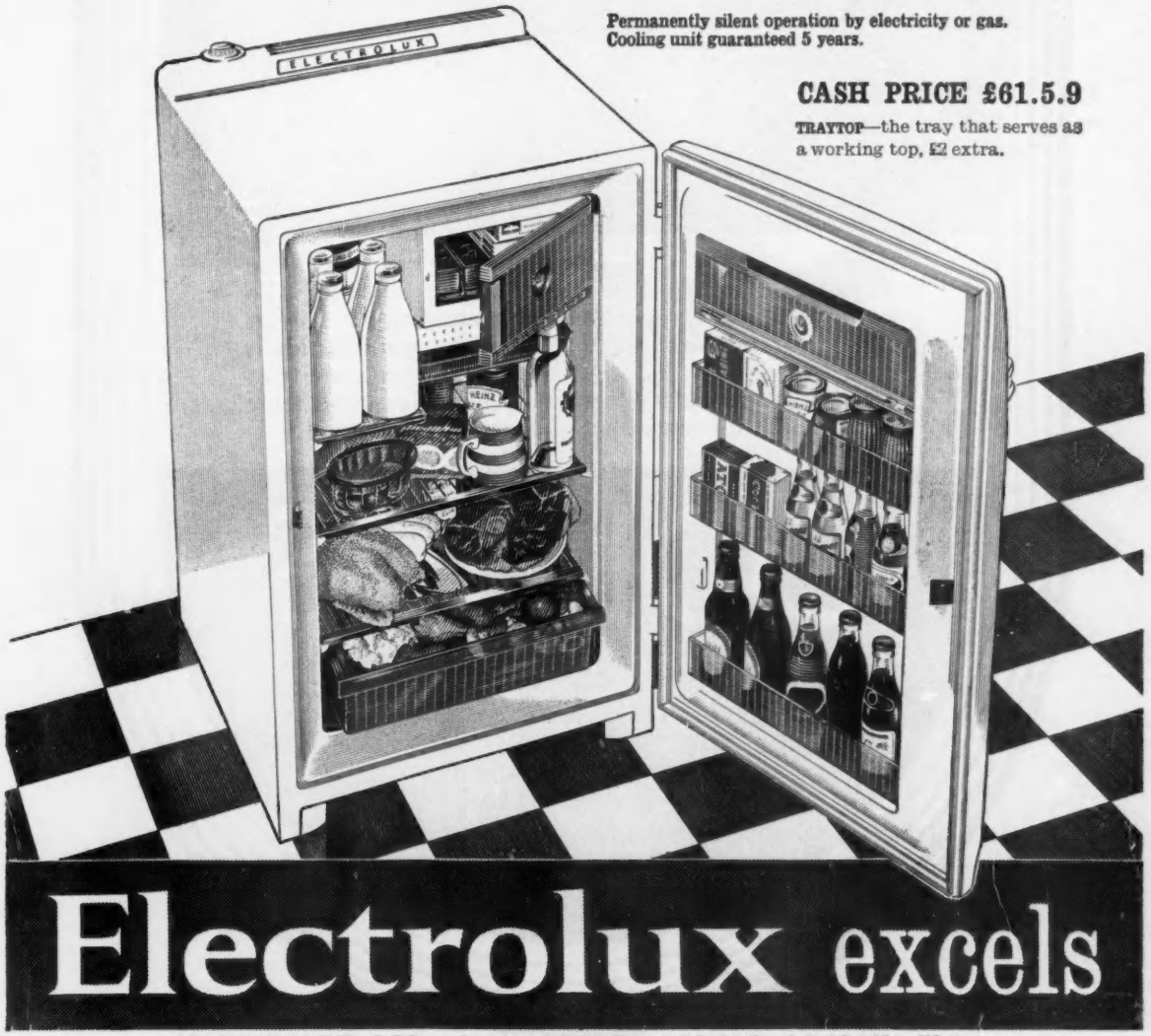

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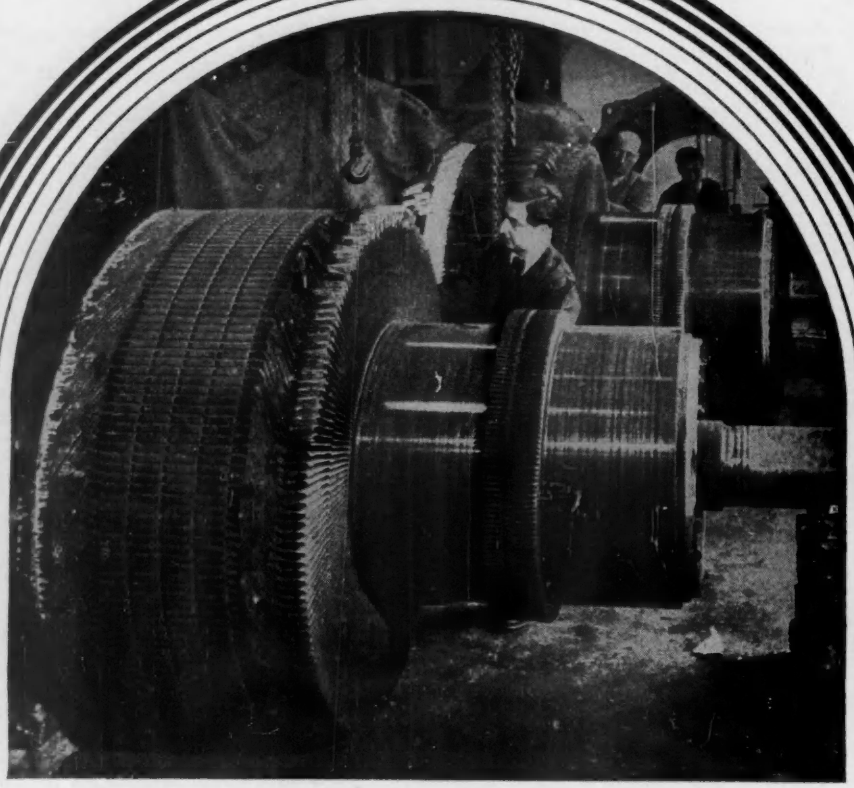

Engineers' Language! For every Plant Engineer who swears at Collins, there are ninety-eight and a quarter who swear by them. Engineers being engineers, this is quite something. As we were saying, we show two 1500kW 240-volt 600 r.p.m. D.C. Generators, one being stripped out for rewinding, t'other being rewound.

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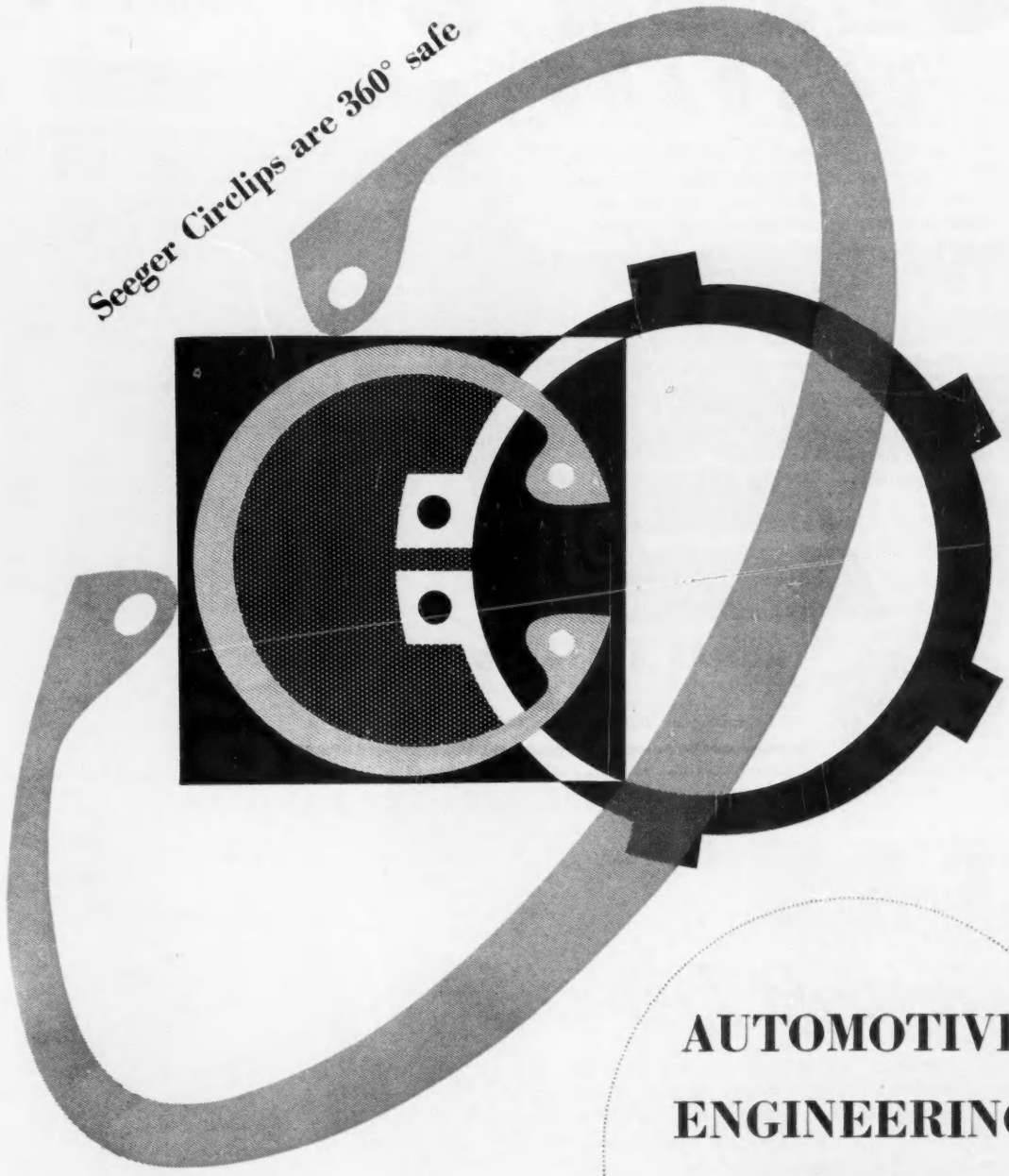

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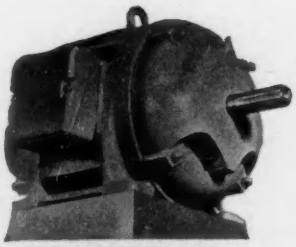
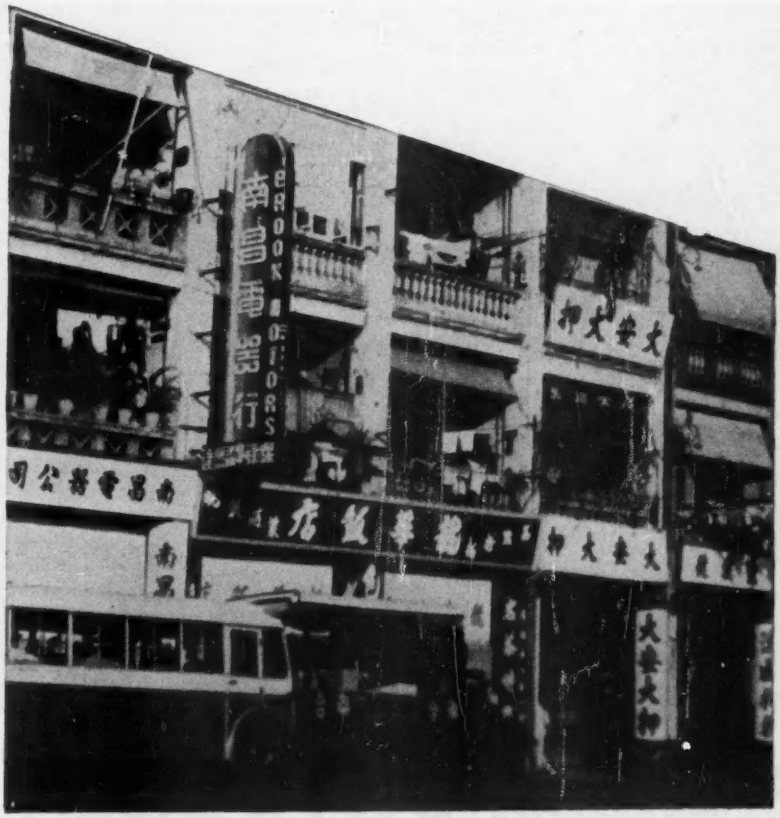


BROOK ELECTRIC MOTORS



BROOK MOTORS LIMITED - HUDDERSFIELD

60/3

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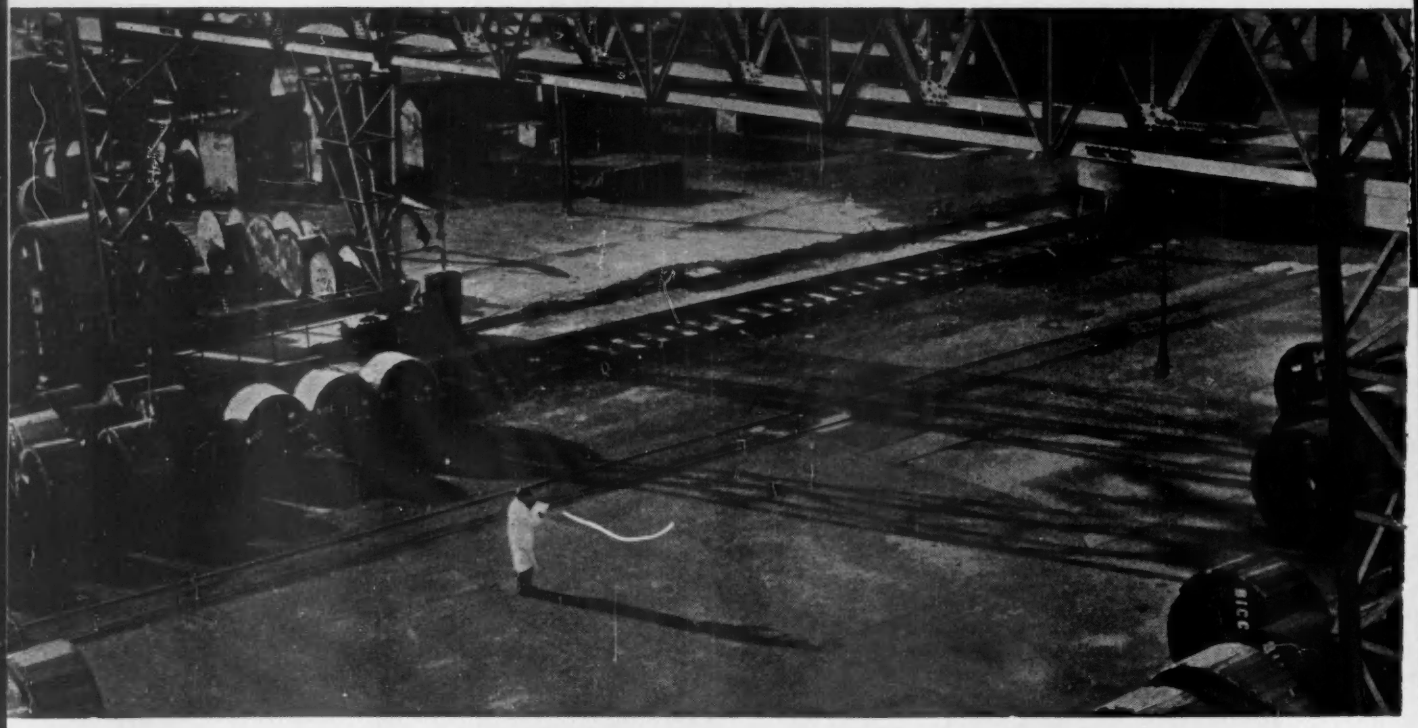

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today's stock orders . . . get moving today

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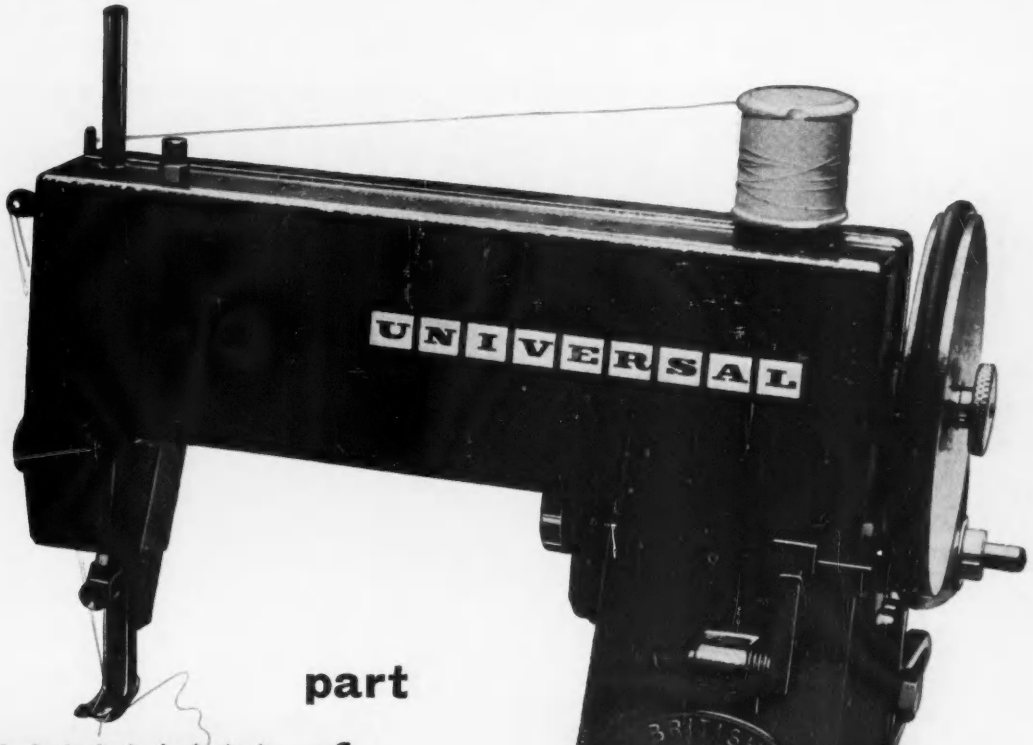
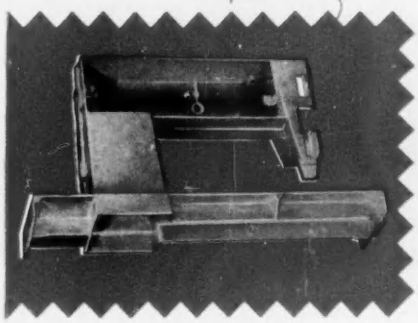


part of the pattern



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THE SEWING MACHINE...
a recurring feature of the British domestic scene.
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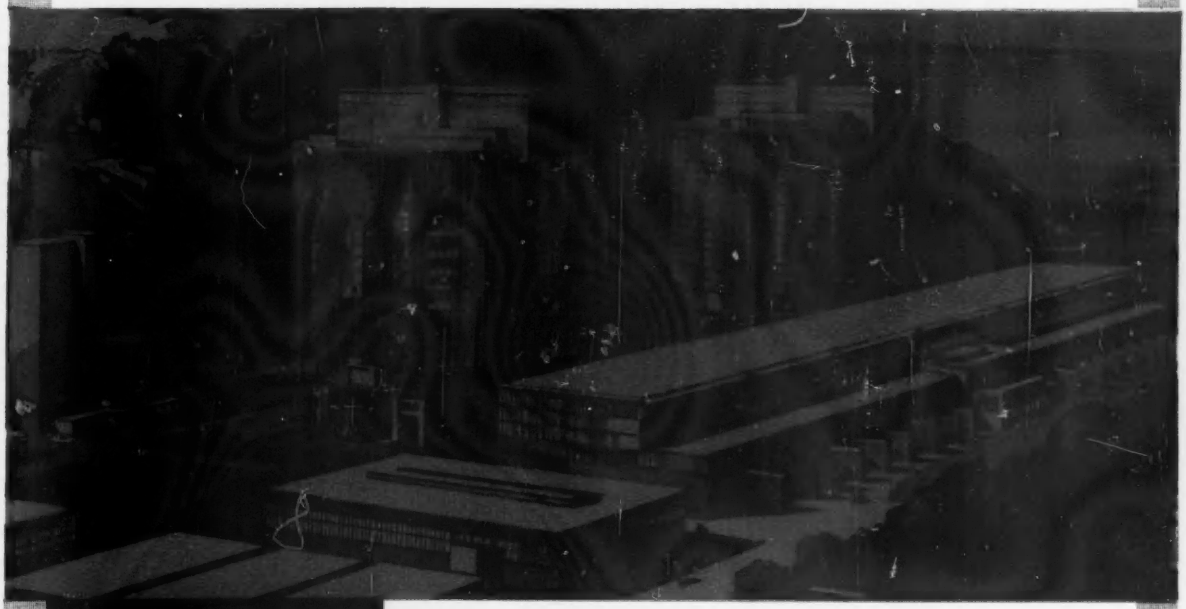
all the cable at Hunterston

is pg

19,500 yards of Pirelli-General 132 kV. single-core oil-filled cable are being installed between the transformers at the power station and switching station. The insulation of this cable is designed for 110 kV/cm. maximum working stress.

With the completion of this installation the whole of the cabling at Hunterston will have been carried out by Pirelli-General.

Hunterston is being constructed by the G.E.C.-Simon Carves Atomic Energy Group. Consulting Engineers to South of Scotland Electricity Board, Kennedy and Donkin.



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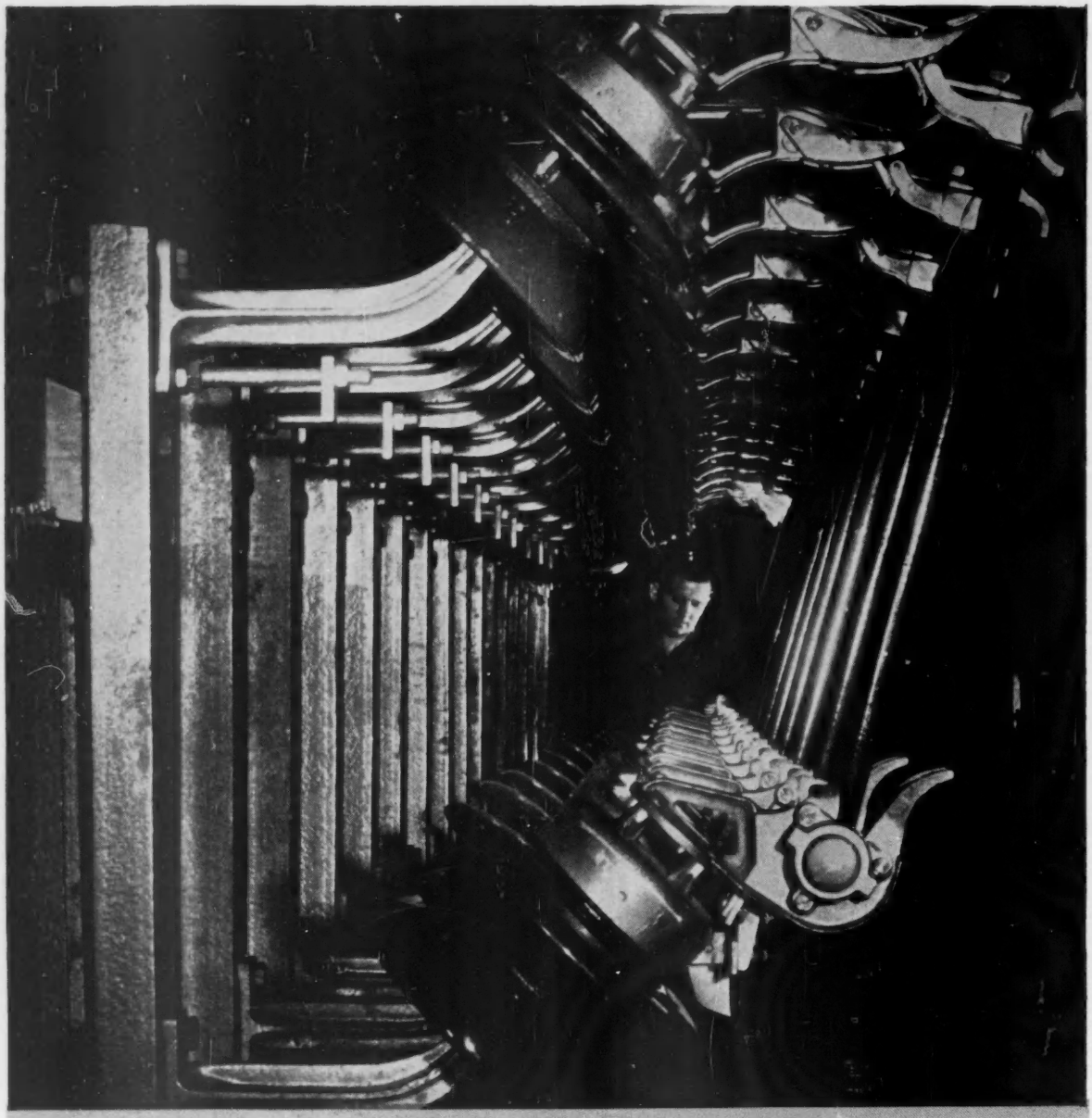
PIRELLI-GENERAL CABLE WORKS LIMITED

SOUTHAMPTON AND EASTLEIGH



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J. & P. is a firm that has built its reputation on quality and service. A large firm, and yet a firm that is not too large to give each customer individual attention. A firm that can give *you* individual attention.

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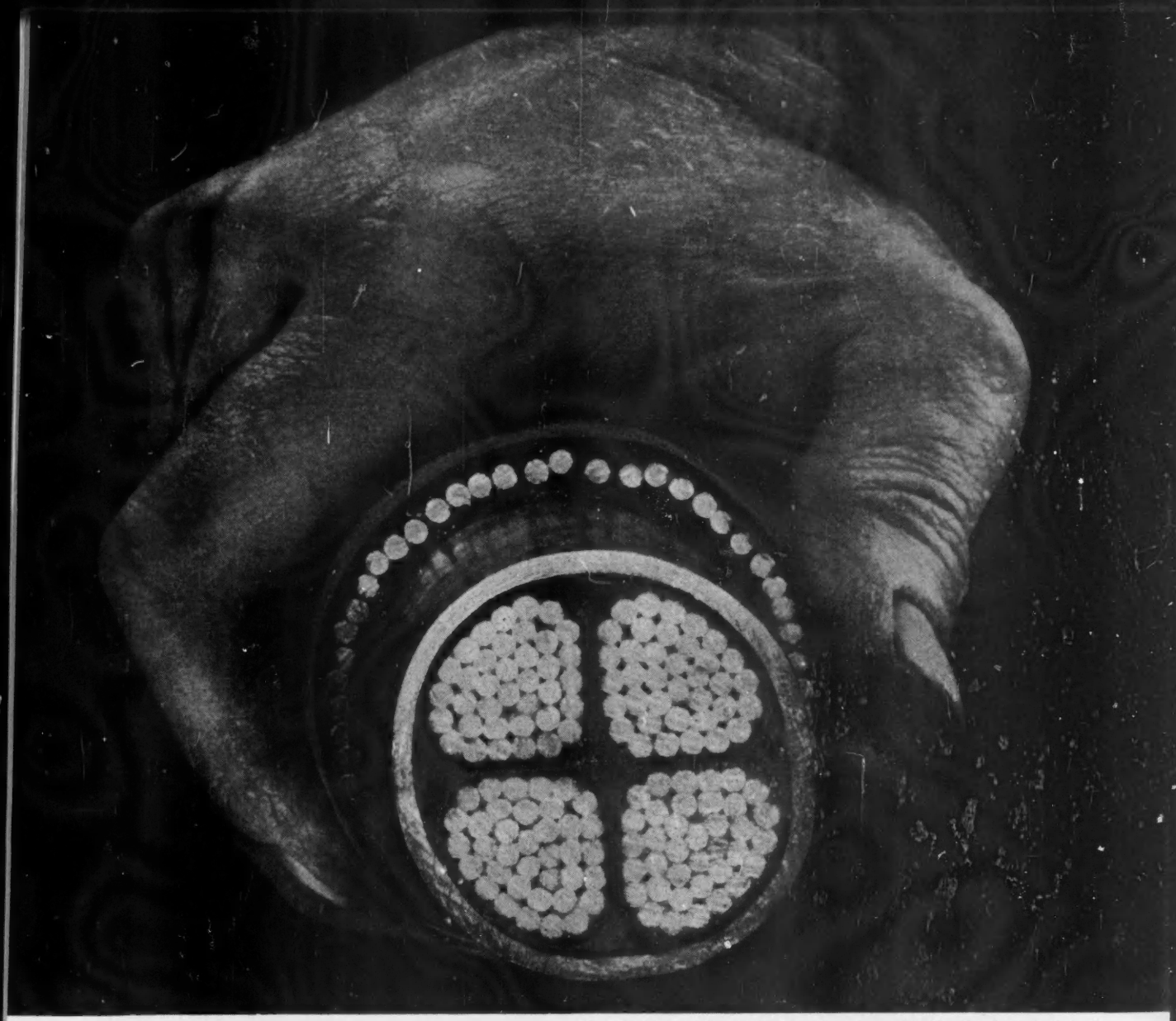

Most Londoners who see modern aluminium cable like this being laid don't realize that last year it saved them £100,000 over conventional copper cables . . .

Last year this cable saved London £100,000. How?

Our picture shows a typical electrical cable. Notice its four conductors. They are made of aluminium instead of copper. By using cables with aluminium conductors, London saved about £100,000 last year. How?

The price of copper varies considerably. Recently it has fluctuated between £240 and £270 a ton; at times it has been much higher. Aluminium costs £186 a ton and its price is steady. More important, a ton of aluminium provides twice as much conductor material as a ton of copper. Consequently, aluminium is now the cheapest conductor material and, in nine cases out of ten, the most economical for the job. And because it is much lighter, aluminium cable is also easier to transport and lay. Jointing is easy and dependable.

Aluminium and power Progressive power authorities are turning to aluminium cables to help them offset rising costs. So is industry at large, for whether insulated with paper, rubber or plastic, aluminium conductors provide a much cheaper way of handling heavy currents—in factories, office buildings, mines and ships.

Alcan's part Through research, we are working to make sure that aluminium holds its lead as the cheapest conductor metal and that its many inherent technical advantages are fully exploited. With 4,650,000 h.p. of hydro-electric power at our elbow, we are smelting aluminium in tremendous volume, and as demand increases we can readily step up our capacity. This volume production helps to keep the price stable.

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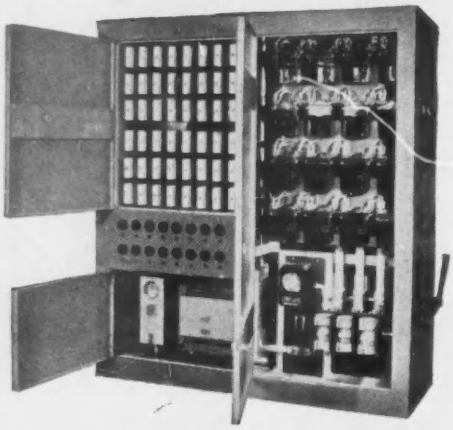

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With the special off-peak tariffs now available through the electricity authorities the overall costs of thermal storage space heating has been reduced to a most economical figure. We are specialists in the design and manufacture of automatic panels for space heating control and have supplied panels handling up to 500 kW.

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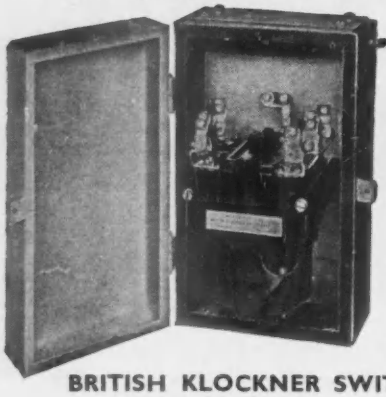

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FOR SILENT OPERATION. All models can be fitted with D.C. operating coil and rectifier.

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TERMINAL BLOCKS 5-75 AMP.

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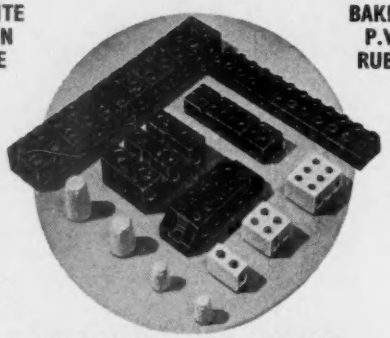

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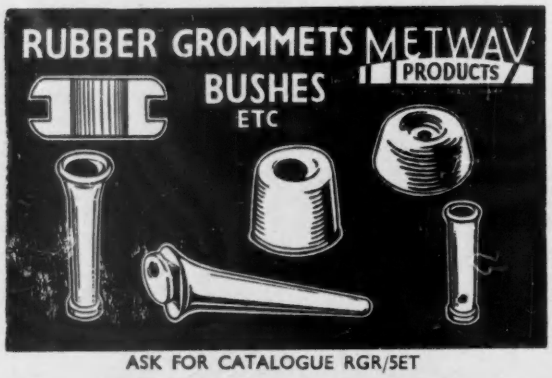

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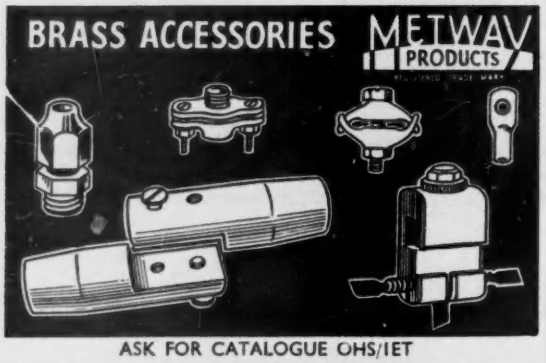

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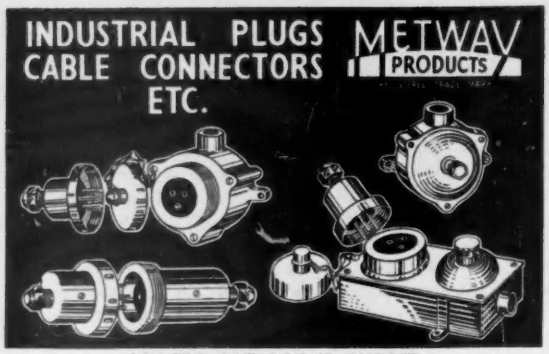

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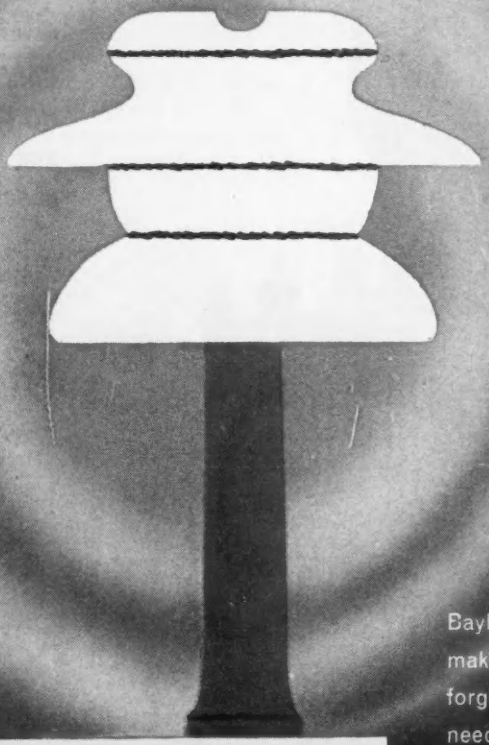
BJB CARRY POWER ACROSS THE WORLD



Bayliss, Jones and Bayliss make all the galvanised forgings and steelwork needed for safe, efficient transmission lines—whether it's a local distribution circuit or a high voltage network—and their equipment is used by Electricity Authorities all over the world. *Most standard items can be delivered from stock.*

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For shunt compensating . . .
Connected to 11kV tertiary windings of transmission transformers and operating on 3 phase, 50 cycles system. O/N type cooling.

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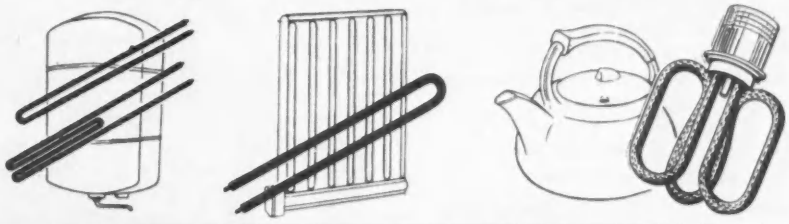

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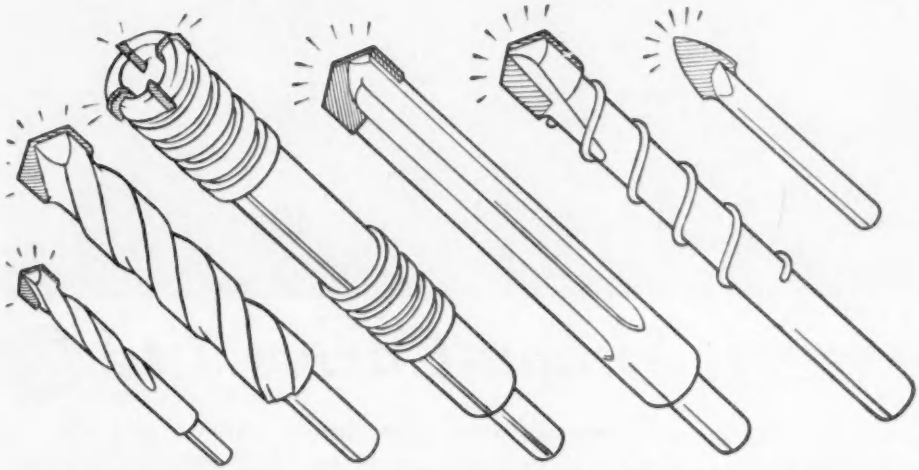

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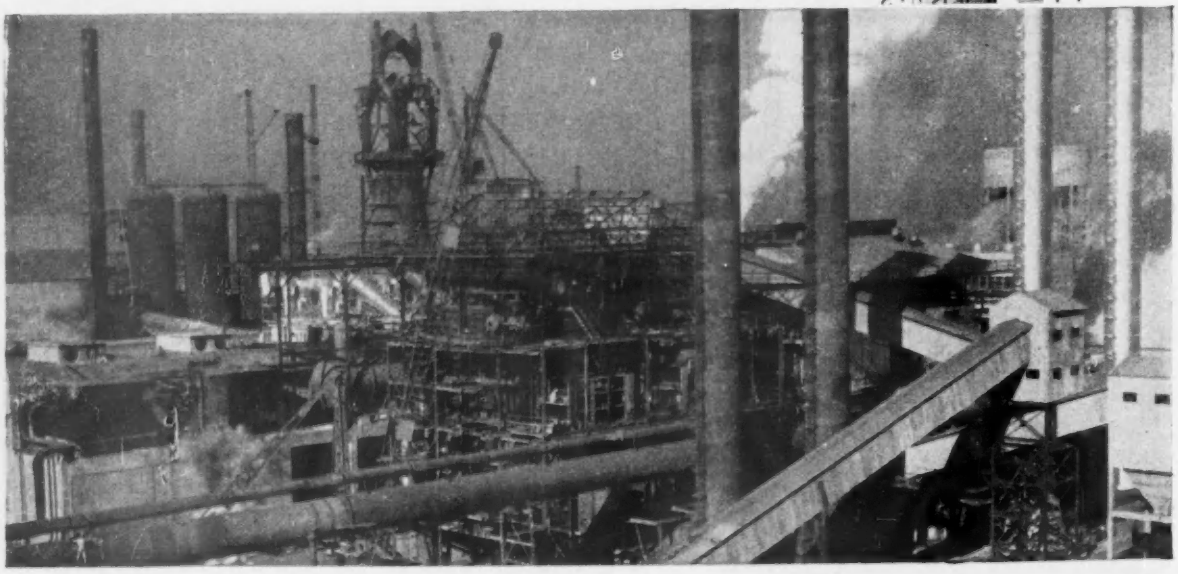
THE POWER BEHIND THE GODDESS

The Steel Goddess was the description given recently to the new Durgapur steelworks. This was apt not only because of its immense importance to Indian steel, but also because Durgapur means 'the place of Durga' and Durga is the ten-armed Goddess of Bengal.

The power behind the annual production of one million ingot tons of steel is one of our many responsibilities at Durgapur. The Goddess's heart, the power plant, will consist of four Simon-Carves water tube boilers producing steam for vital steelworks services; the associated fuel and ash handling plants, cooling system and steam distribution network will all be Simon-Carves designed and built.



COMPLETE POWER PLANT BY *Simon-Carves Ltd*

SIMON ENGINEERING GROUP

STOCKPORT, ENGLAND

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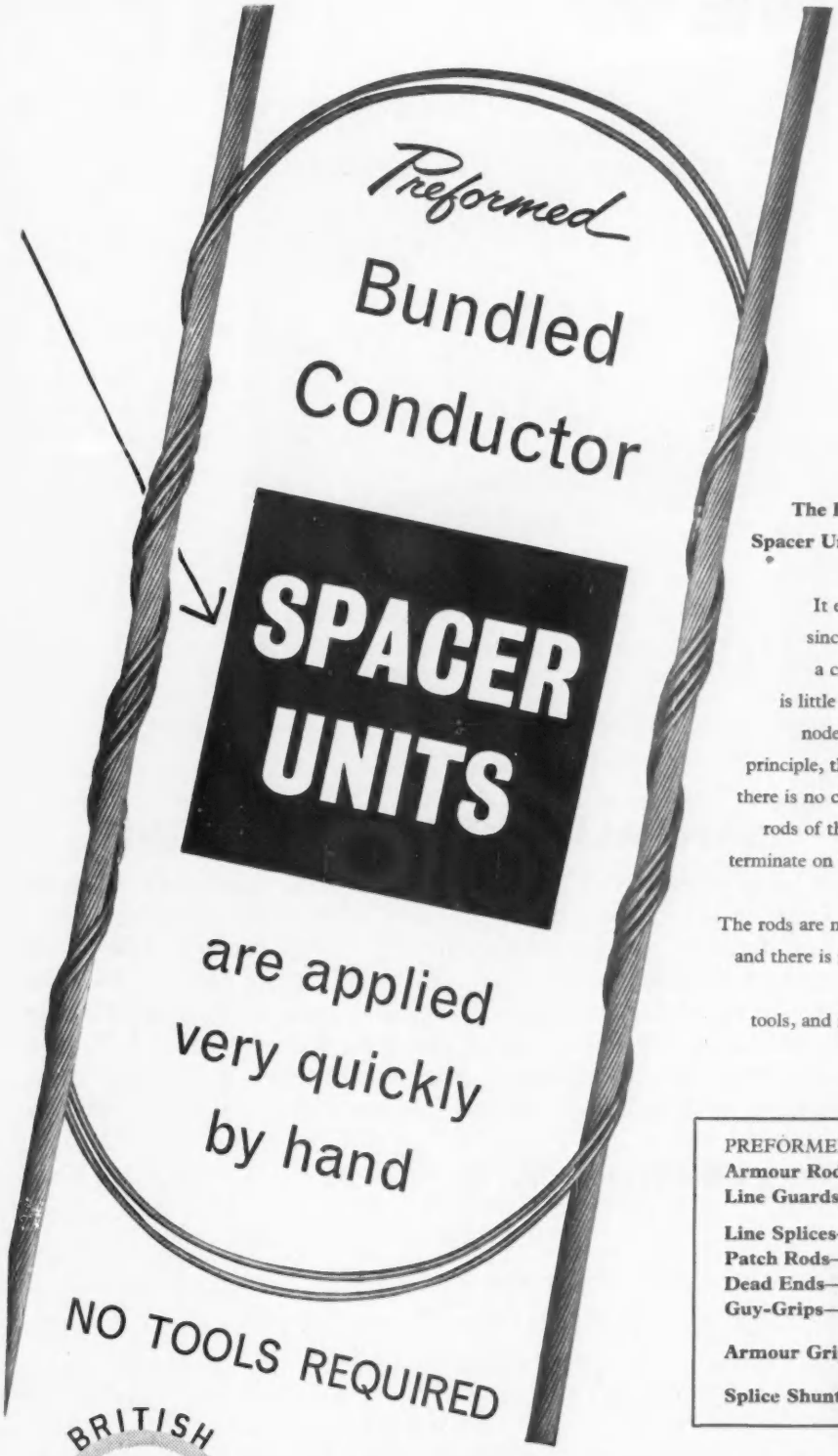
At Durgapur we are also building the coke ovens and coke handling plant, the by-product plant, the coal washery, blending and handling plant and the inter-connecting services for gas, tar and steam.

SC 235

PREFORMED TECHNICAL BULLETIN No. 3



The PREFORMED Bundled Conductor Spacer Unit is an entirely new development in the field of spaced conductors.

It employs no bolted knuckle fittings and since the weight of the unit is spread over a considerable length of conductor, there is little danger of the formation of a vibration node. Since it employs the PREFORMED principle, the unit grips gently but positively and there is no chatter between the conductor and the rods of the unit. The rounded ends of the rods terminate on the inside of the assembly and corona emission is minimised.

The rods are made of a compatible aluminium alloy and there is no risk of conductor or rod corrosion.

The unit is applied by hand without tools, and installation time by a skilled linesman can be as low as two minutes.

PREFORMED Line Products also manufacture:

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Line Guards—*for conductor protection at insulators*
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Armour Grip Suspension Units—*a revolutionary suspension clamp*
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AP 20

NEW

SANDALITA CONSUMERS' UNIT

A new competitive range of Consumers' Electricity Control Units in attractive sheet steel cases with ample knockout holes and finished steel hammered grey stove enamel, having 60 ampere Double Pole AC Main Switch and Single Pole and Neutral fuse ways, with porcelain " Duplex " units of 30 amp, 15 amp and 5 amp 250 volt capacity, having rewirable or H.R.C. fuse carriers. The cases, which are complete with earthing bars, are so designed that any combination of these fuses may be fitted at will.

PRICES & DETAILS, SEE LEAFLET 59/59

by **SANDERS** WEDNESBURY

WM. SANDERS & CO. (WEDNESBURY) LTD., WEDNESBURY, STAFFS.

NEWS SHEET

EFTA now in force with first cut of 20% in tariffs by the seven countries. Greater realisation needed of possibilities of new trading community. In view of low external tariffs of Scandinavian countries any increase of electrical trade will be difficult. (1, 29)

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Earthing to water mains may cause trouble for water engineers. Disconnection of joints in water pipes during servicing may lead to danger to workmen; presence of oxide on copper fittings may result in d.c. component of leakage current and with cathodic protection some insulation on pipes may be used. (10)

Company changes: Simms group acquire Dawe Instruments and associated LMK Manufacturing for £½m. . . . Dutch Stokvis group form UK subsidiary to market continental appliances . . . Benjamin Electric and Australian Bradley's Electrical form joint company to manufacture lighting fittings in NSW . . . Consortium of electrical co's bid against Pye for Telephone Mfg. Co. . . . Electronic Instruments acquired by Cambridge Instrument . . . Metal Industries obtain remaining Lancashire Dynamo shares. (31)

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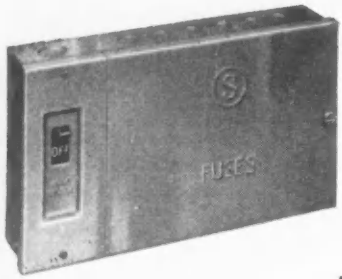

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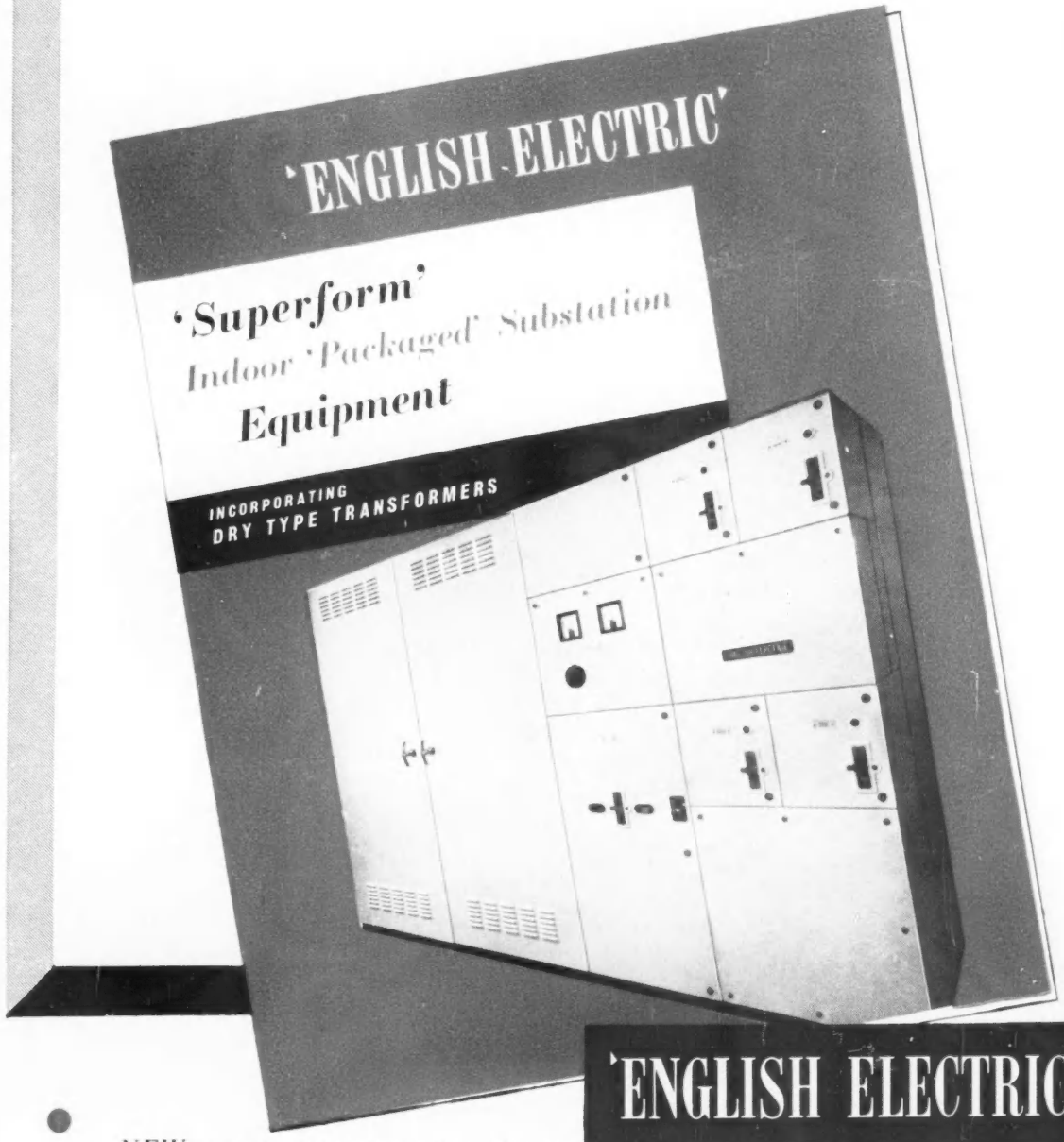
what is a
'Packaged' Substation ?



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FG. 52

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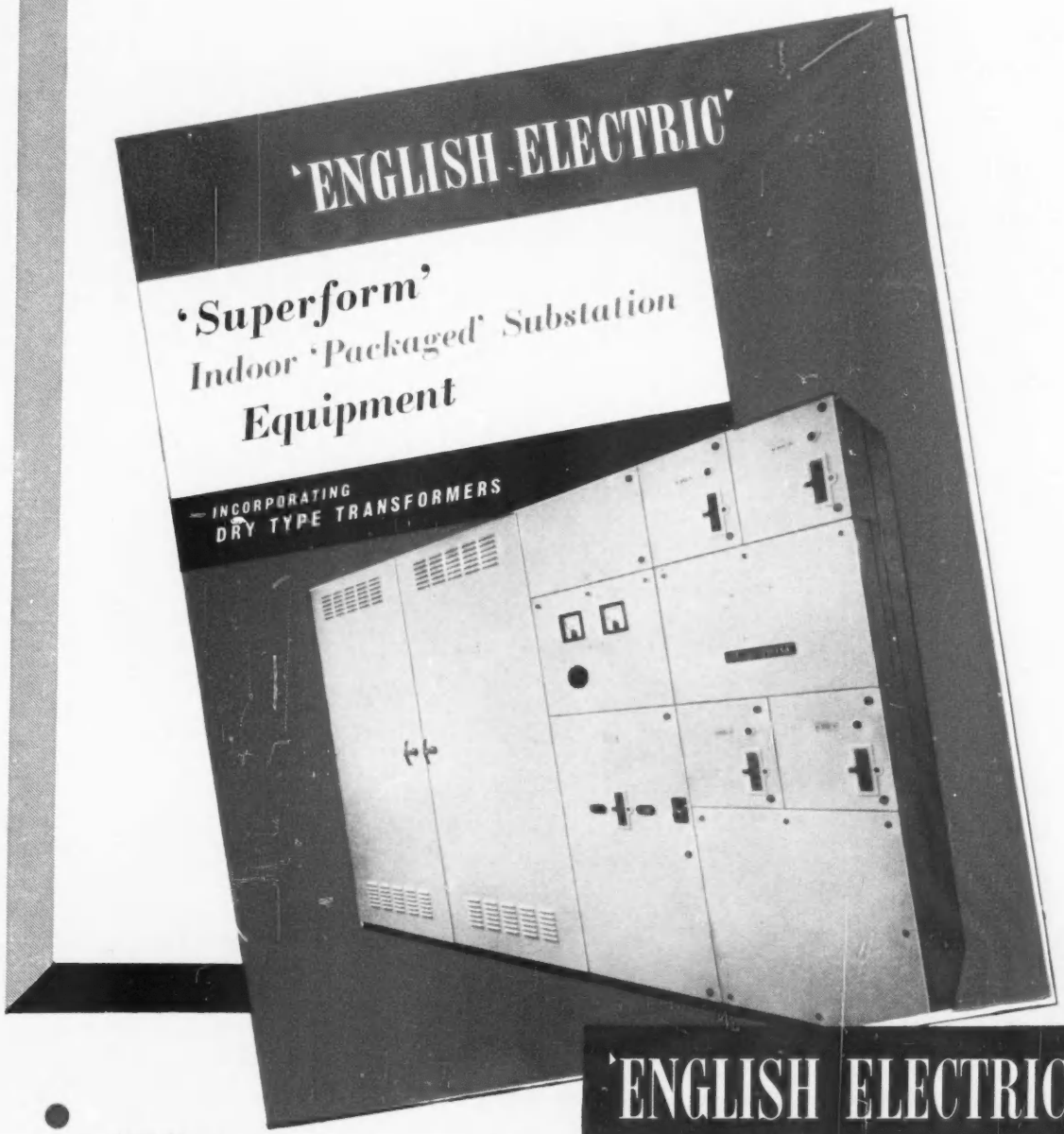

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FG. 52
C

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There is a handbook on Earth Testing which is an invaluable guide to the functions and versatility of the 'Megger' Earth Tester, and contains full details on methods of earth testing. For your free copy, write for Publication EL247.

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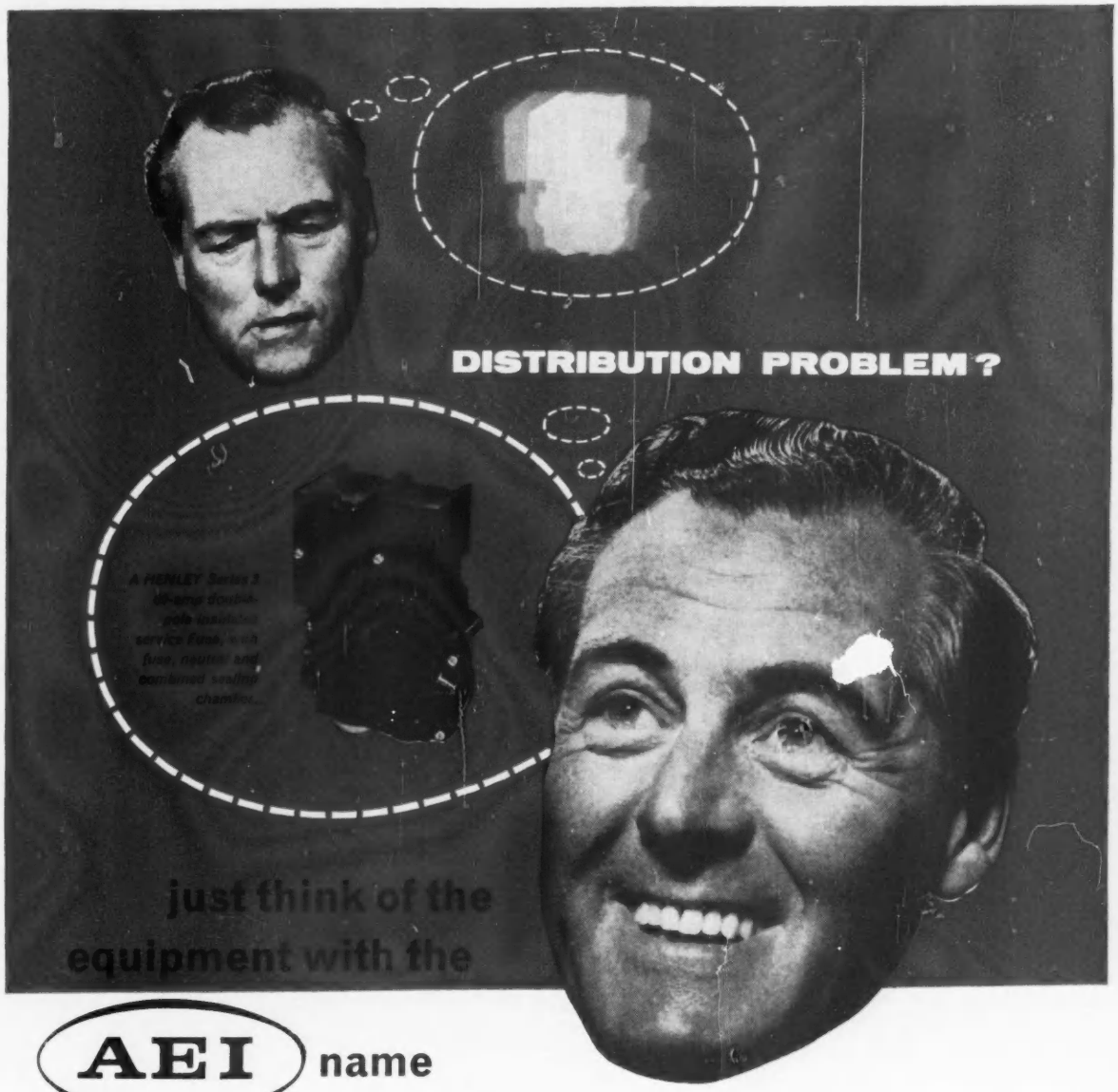

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Distribution pillars and panels—Underground disconnecting boxes, branch boxes, service boxes and straight-through joints—Indoor and outdoor terminal boxes—Indoor and outdoor service fuses—H.T. and super-tension joints and sealing ends—Overhead service accessories—Rising mains systems—House service fuses and consumers' control units—Jointing materials and accessories of every description.

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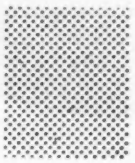
WHY INDUSTRY IS CHANGING TO CLASS C AND CLASS H TRANSFORMERS

THEY ARE FAR BETTER



Class C & Class H *silicone-insulated, dry-type transformers are fire and explosion proof. They are not affected by dust and humidity. And because they will withstand repeated overloading, rating does not have to be based on peak loads. For safety, reliability and low maintenance costs, silicone-insulated transformers hold every advantage.*

THEY ARE OFTEN CHEAPER

First consider all the expenditure incumbent upon the installation of oil-filled transformers. Special bunkers and fireproof vaults are usually needed—and special fire-fighting equipment. The installation is often located a considerable distance from the load centre—which implies expensive low-voltage cable runs.

Now consider the very considerable cost-cutting advantages of Class C and Class H transformers as demonstrated for instance at the Kent factory of Medway Paper Sacks Ltd, a member of the Reed Paper Group. Here a 750 kVA 3-phase air natural cooled transformer, built by Ferranti Ltd, has been neatly mounted within the roof truss space. Space limitations—making it undesirable to build an adjoining substation for a Class A unit—together, of course, with freedom from fire hazard, were the major considerations. As a Group technician pointed out, the transformer's low weight enabled it to be sited thus, on a moderately-sized platform, making it possible to run 'a very nice low voltage distribution' to individual machines without floor excavations to accommodate long, costly cable runs.
And so, in simple indisputable terms, it often costs less to have all the advantages of a Class C or a Class H installation.

Midland Silicones Ltd supply the silicone resins and elastomers used in the manufacture of Class C and Class H transformers. Here is a list of well-known British manufacturers producing silicone-insulated dry-type transformers for the United Kingdom and overseas.

Associated Electrical Industries (Manchester) Ltd
Bonar, Long & Co Ltd
Brentford Transformers Ltd
Brush Electrical Engineering Co Ltd
Bryce Electric Construction Co Ltd
Crompton Parkinson Ltd
The English Electric Co Ltd
Ferranti Ltd
Foster Transformers Ltd
The General Electric Co Ltd
Gresham Transformers Ltd
Hackbridge & Hewittic Electric Co Ltd
London Transformer Products Ltd
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Transformers (Watford) Ltd
Woden Transformer Co Ltd
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MSE.1

A new Grommet development

THE DOUBLE SEALING EMPIRE RUBBER GROMMET

infinitely accommodating in use: considerably reduces range of sizes because the same grommet can be used with several plate thicknesses or cable sizes

PAT. APP. No. 5255/59

This newly developed self-conforming grommet, because it is immediately self-locking against the elements, is the solution to many of an engineer's sealing problems.

Any one size will not only accommodate itself to a variety of mounting plate thicknesses, but (designed for cable or control rod) will take these in a variety of sizes and be weather-, water- and dust-proof at a variety of angles to the cable or rod.

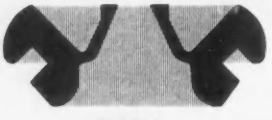
Because of its capacity to conform to many varying requirements, it enables a workshop stock range of grommets to be reduced to perhaps one tenth of that at present maintained.

THE NEW BLIND GROMMET

FREE

Note how when sprung into position the grommet provides a perfect double seal by its own permanent pressures. The angled groove also creates a tight pressure hold on the metal plate.

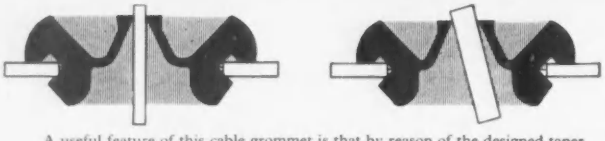
THE NEW DESIGNED GROMMET



FREE

FITTED

In the cable grommet variety the same double pressure seal is created, allied to tight seal on various diameters of cable. This new grommet gives sound sealing at *all* vital points.



A useful feature of this cable grommet is that by reason of the designed taper of the cable entry and the flexibility of the web, a considerable angle of cable entry and a variety of cable size are possible. This avoids necessity for special grommets with angled bores.

In the conventional grommet, only one thickness of plate and only one size of cable can be accommodated. No effective seal is afforded by the parallel groove.

Now being produced in a range of sizes.

THESE GROMMETS WILL SOLVE YOUR SEALING PROBLEMS.

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Controlled Circulation Reheat Boiler Units

These large capacity International Combustion steam raising units, for which contracts have recently been placed by the Central Electricity Generating Board, have been designed for assisted and controlled circulation.

200 MW

At HIGH MARNHAM Power Station the first of the five 200 MW units has been commissioned.

Evaporation . . . 1,400,000 lbs. per hr.
Steam Pressure . . . 2,450 p.s.i.g.
Superheat Steam Temperature . . . 1,060°F
Reheat Steam Temperature . . . 1,005°F

550 MW

This capacity from a single boiler unit will be greater than that of any other known design in the world. The 550 MW twin furnace unit to be installed at THORPE MARSH Power Station will have the following operating conditions:

Evaporation . . . 3,750,000 lbs. per hr.
Steam Pressure . . . 2,400 p.s.i.g.
Steam Temperature . . . 1,055°F
Reheat Steam Temperature . . . 1,055°F

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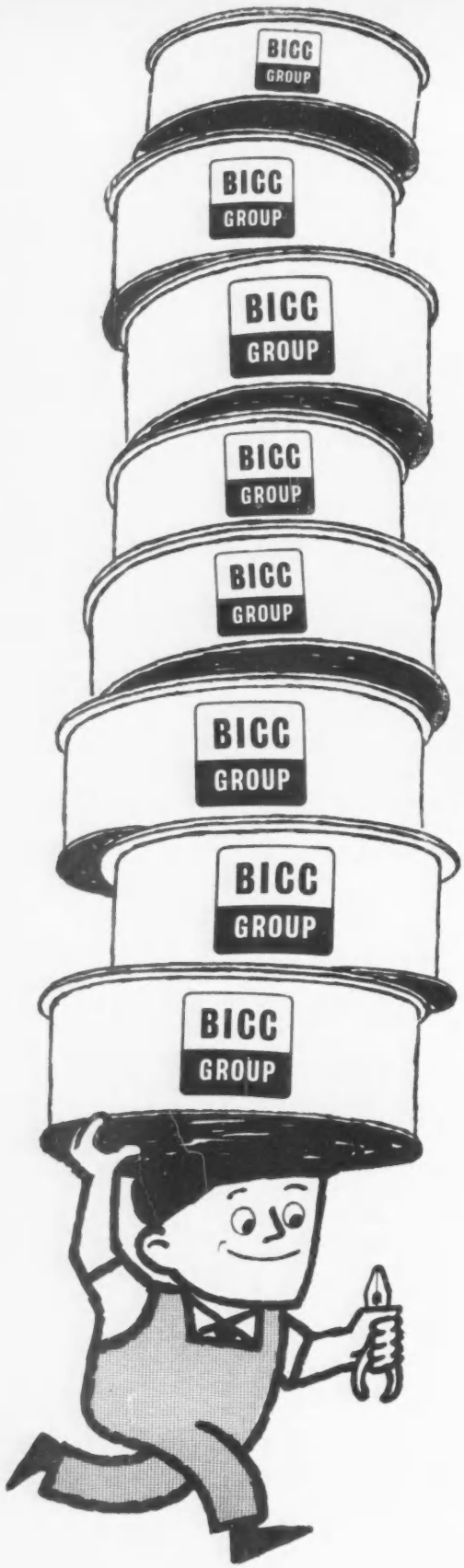

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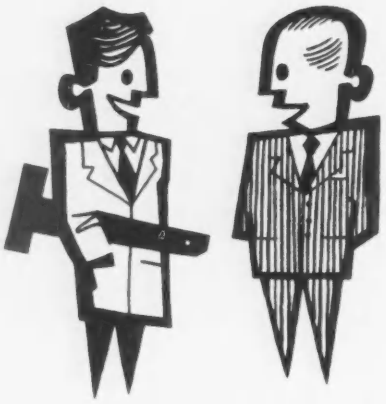

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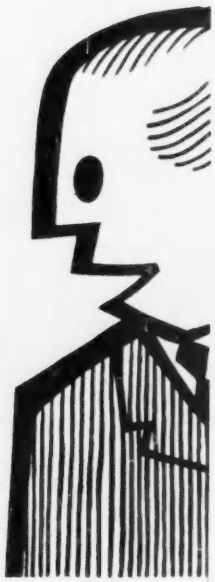

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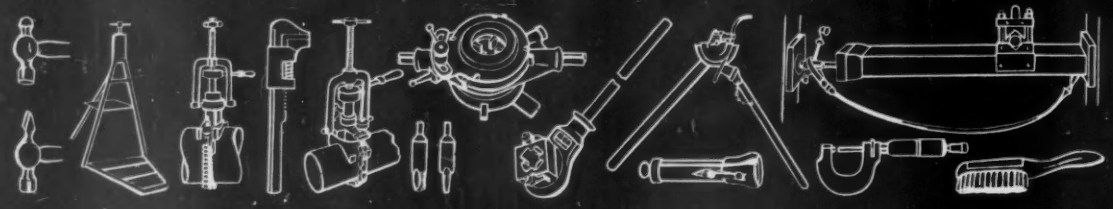

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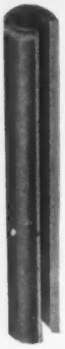

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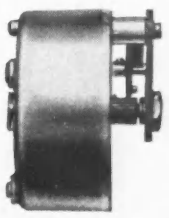

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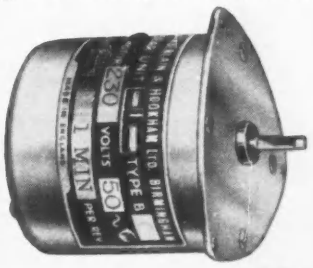

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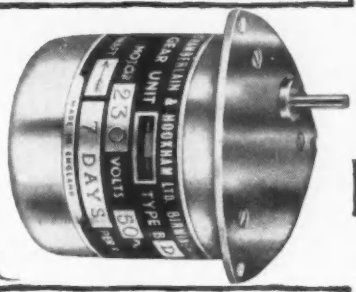

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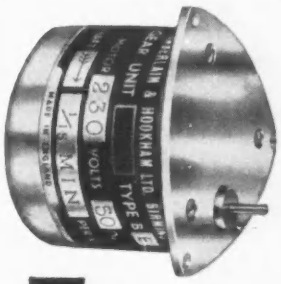

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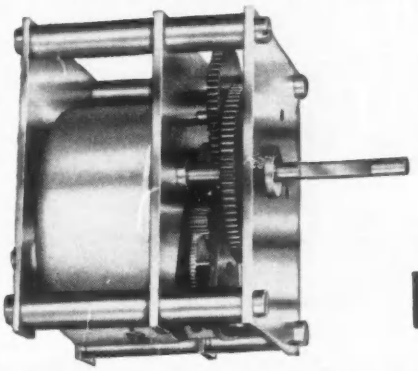

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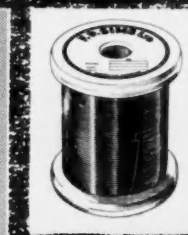

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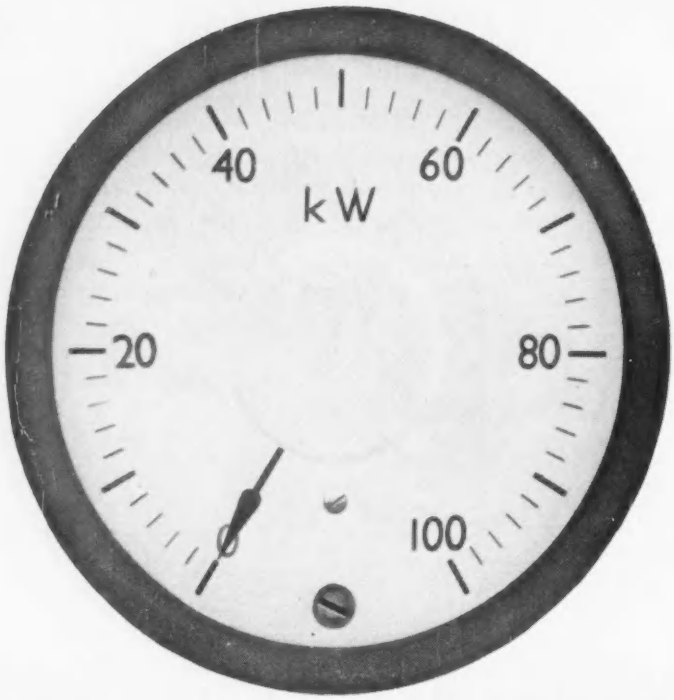

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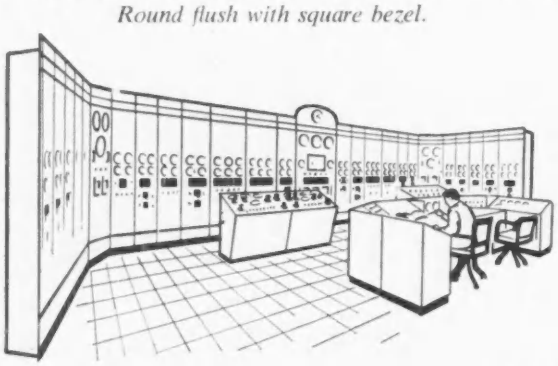

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THURSDAY 7 JULY, 1960
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ELECTRICAL TIMES

SARDINIA HOUSE, SARDINIA STREET, LONDON, W.C.2
Telegrams: Equivolt . Estrand Telephone: HOLborn 6016

Dans ce numéro

Les machines miniatures pour l'etude des Reseaux 3

Les machines qu'on appelle micro-alternateurs peuvent être employées pour l'étude du fonctionnement de grands turbo-alternateurs. Elles peuvent être munies d'instruments pour mesurer les quantités méchaniques telles que les couples, ainsi que les quantités électriques. Les résultats obtenus sur une certaine installation ont démontré que des tensions dangereuses peuvent se produire par suite de couples oscillantes résultant de court-circuits, et ils ont montré l'effet d'avoir négligé des facteurs tels que l'amortissement lorsqu'on emploie des techniques analytiques dans les calculs de court-circuits. On a étudié également les couples pendant l'opération asynchrone.

Transmission a haute tension 11

Les discussions à la section e.h-t. de la CIGRE ont souligné les grandes discordances d'opinion sur le choix de la prochaine mesure à prendre en ce qui concerne le voltage de la transmission à e.h-t. L'avantage des fils de mise à la terre pour la protection contre la foudre s'est montré par l'analyse du fonctionnement de 73 lignes dans diverses parties du monde, opérant au-dessus de 22 kV. Elles ont révélé aussi que les isolateurs sont les élements les plus vulnérables.

L'economie dans l'operation du réseau 21

Des études canadiennnes suggèrent que des économies de l'ordre de £100 par jour sont possibles par l'application de calculs de répartition de charge compliqués dans un réseau qui comprend trois centrales thermiques et 2 centrales hydro-electriques. En Russie on a considéré les mérites relatifs de l'équipement centralisé et décentralisé là où il y a cônrole automatique de fréquence de charge. Ce dernier système économise les canaux télémétriques mais il réduit le dégré de contrôle exercé par le répartiteur de charge.

In dieser Nummer

Netzüberprüfung mit Hilfe von Kleinstmaschinen ... 3

Sogenannte "Mikrowechselstromerzeuger" lassen sich zur dynamischen Untersuchung grosser Turbogeneratorsätze verwenden. Hierzu können sie mit Geräten ausgerüstet werden, die nicht nur mechanische Grössen wie z.B. Drehmomente, sondern auch elektrische Werte messen. Die mit einer derartigen Einrichtung erzielten Ergebnisse beweisen, dass durch schwingende Drehmomente nach Kurzschlüssen gefährliche mechanische Beanspruchungen entstehen können. Ferner wurden die Auswirkungen der ungenügenden Beachtung gewisser Faktoren, wie z.B. der Stromdämpfung bei Anwendung analytischer Methoden der Kurzschlussberechnung, festgestellt. Drehmomentschwankungen in Asynchronbetrieb sind ebenfalls auf dieser Weise untersucht worden.

Hochspannungsleitungen 11

Bei den Sitzungen der Gruppe Ultrahochspannungstechnik auf der C.I.G.R.E.-Tagung haben die Diskussionen gezeigt, die weit die meinungen über die Frage der Wahl der als nächsten festzulegenden Hochspannungsstufe ausseinandergehen. Durch Analyse der Betriebsdaten von 73 in verschiedenen Teilen der Welt errichteten Hochspannungsleitungen mit einer 225 kV übersteigender Belastung wurde der Wert der Erdleitungen als Blitzschutz unter Beweis gestellt. Diese Untersuchung liess ausserdem die Isolatoren als den gefährdetsten Teil eines Hochspannungsnetzes erkennen.

Verteilungskosteneinsparung 21

In Kanada angestellte Untersuchungen lassen erkennen, dass Einsparungen in der Grössenordung von £100 im Tag durch Anwendung verwickelter Lastverteiler-Berechnungen in einer drei Dampfkraftwerke und zwei Wasserkraftwerke umfassenden Gesamtanlage erzielt werden können. In Russland sind vergleichende Studien über zentralisierte und dezentralisierte Anlagen gemacht worden, unter der Voraussetzung, dass eine automatische Belastungs-Frequenz-Steuerung verwendet wird. Diese Betriebsart kommt wohl mit weniger Fernmessleitungen aus, setzt aber den Steuerungsgrad, den der örtliche Lastverteiler ausüben kann, herab.

Micro-machine Studies at Imperial College 3
by B. Adkins, M.A., D.SC.(ENG.), M.I.E.E.

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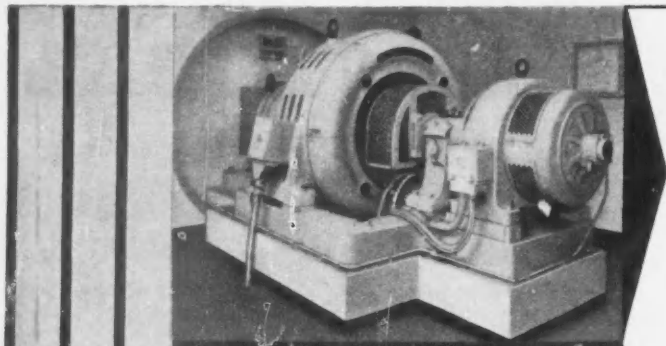
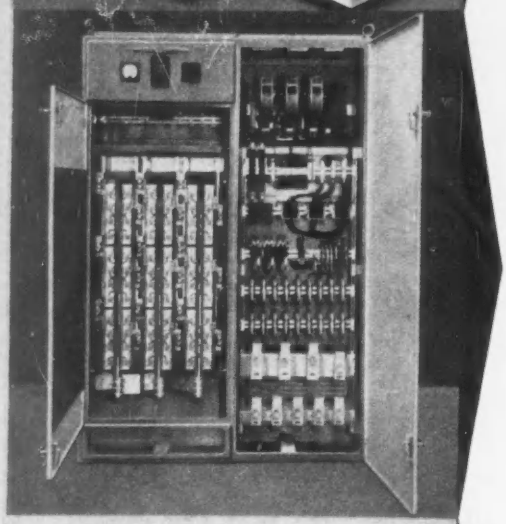
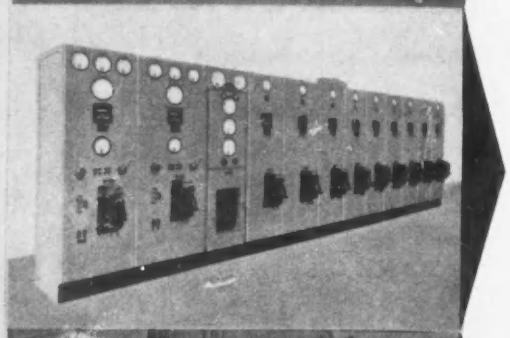
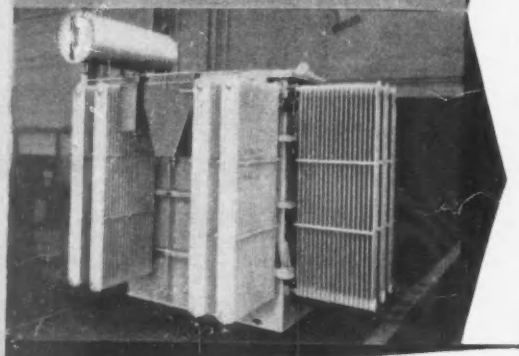
SUBSCRIPTION RATES: United Kingdom £4, Overseas £4 10s per annum. Canada and USA $12 per annum. Subscriptions are payable in advance and may commence with any issue. Overseas subscriptions may be paid by banker's draft, cheque, international money order or credited to the Electrical Times Ltd., at Coutts and Co., 440 Strand, London WC2. Single copies price 1s 6d. Postage 6d.









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ELECTRICAL
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ESTABLISHED 1891

THURSDAY, 7 JULY, 1960

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ROY BALDWIN, M.I.E.E., Barrister-at-Law

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K. C. POUNDS, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E.

News Editor:
T. W. WRIGHT

Comment

7 INTO 6 MAY NOT GO

The European Free Trade Association is in being. The first 20% cut in tariffs between the seven members took place last week. Yet there appears to be insufficient realisation within the country that we are at the beginning of a new era of trading policy. There is none of the general consciousness of a new venture that was manifest on the Continent at the time of the signing of the Rome Treaty. This lackadaisical air may arise from the original hope that EFTA would be a bargaining counter towards participation in the ECM. Unfortunately, to every new proposal for collaboration, the ECM, like a will-o'-the-wisp, seems to draw farther away until it is by no means certain now that if the Seven offered to subscribe to all the provisions of the Rome Treaty such an offer would be accepted. One thing is clear, if trade within the Seven is to be used as a lever with the ECM, then the sooner it becomes an integrated trading community the more effective it will be. But whether with the Six or without, EFTA must become a viable trading unit. The task of contributing to its success rests on every business, and this will not be easy. Our own tariff walls are twice as high as those of the important Scandinavian markets. Within those countries, with their low external tariffs, Germany has already a strong position. On electrical goods, when the EFTA is fully implemented, the maximum preference will be no more than 10%; yet recently there have been considerable inroads into our own home markets from the Continent despite a 20% tariff wall.

DISTRICT HEATING IN EUROPE

One of the prime interests of the World Power Conference is the efficient use of fuels, so it is no surprise to find papers on back-pressure generation in connection with district heating schemes amongst those presented to the recent sectional meeting in Madrid. Perhaps the most promising information disclosed was the development in Czechoslovakia of a relatively simple heat meter which could be clamped to a hot water radiator and would measure the heat put into the room. The difficulty of measuring heat input and the consequent need to charge everyone on a flat rate basis, encouraging profligate use of heat, has always been a difficulty with district heating schemes even when they have proved economically feasible on the basis of reasonable care in use of heat. However, even developments such as this, and the experience reported from Sweden where back-pressure stations compete successfully with hydro-based electricity in the larger towns (but colder climate), are unlikely to bring any marked change to the poor prospects

in the UK. Not long ago, CEGB engineers said publicly that they had investigated about a dozen schemes for possible district heating and all were turned down by the ultimate user because the cost to them, primarily the cost of distribution, was uneconomic. Even the prospect of heating the whole of the City of London from Bankside power station looked only marginally profitable and that, at a time of low interest rates. Spondon "H," that anomaly in the commissioning figures with its 10 MW sets, is a shining exception—and likely to remain one.

ELECTRICAL WHIPPING HORSE

The public inquiry into the tragic fire and explosion in a Glasgow whisky warehouse, which killed 19 firemen and salvage men, has provided an outstanding example of the manner in which electricity tends to be blamed for fires in buildings even today when far more is done by way of investigating causes. In that fire, the damage was such that witnesses reported it was not possible to check on many of the possible, if unlikely, causes of the initial blaze-up. With an inflammable liquid stored in large quantities these must be many. Yet the general impression given by reports was that electricity was the most probable cause—because no other single cause seemed so likely. An interesting point was raised about the use of non-flameproof fluorescent lighting in the warehouse, but this was not finally pressed as a cause of the fire. Moreover, the wiring of the building could not be attacked as out of date; it was only three years old. Presumably, this particular fire will go down amongst the "cause unknown" entries in the official statistics; but the extended evidence at the inquiry shows how strong remains the tendency to put the blame on electrical installations.

USE FOR MICRO-MACHINES

In a comprehensive survey of computer aids to network analysis published in America last year, the micro-network built up from micro-machines was dismissed with the opinion that it "would never become widely used." That is probably a fair judgment so far as any comprehensive study of complex systems is involved, but, as the article beginning opposite demonstrates, there is a large range of work in which the micro-machine can prove useful. It is a direct analogue of the turbine-generator in both its electrical and mechanical parameters and in the many circumstances in which there is interplay between the two the micro-machine provides a powerful experimental tool. The theoretical basis for calculations to show what happens during transient faults in a power system is far less firmly established than that for steady state conditions. For all the wonders of the electronic digital computer, such equipment can only apply its mathematics to accord with predicted rules. It is with the validity of some of the rules, in terms of the assumptions they necessarily involve, that some of the work with micro-machines has been carried out. Although the investigations described in the article were mainly concerned with the internal behaviour of the machine, the list of other work being undertaken at Imperial College extends into broader control problems of wide interest in power system operation.

HELPFUL INSPECTORS

One effect of the Clean Air Act has been to place power stations under the surveillance of the Alkali Inspectorate so far as stack emissions are concerned. Last week's annual report of the Inspectorate accordingly contains a lengthy section on power stations. The impression it gives is that the supply industry has much to gain from the attentions of this highly qualified body. On the one hand, there is authoritative testimony to the willingness of the CEGB to co-operate in getting the best possible clean air conditions and independent endorsement of the tall-chimney approach to the problem. Solution of any pollution problems, the inspectors say in their report, is designed into large modern stations. On the other hand, the CEGB is gaining from this independent audit of their stations from the air pollution aspect. Would they have discovered otherwise that poor maintenance was seriously affecting the effectiveness of grit arrestors at many medium-sized power stations? It is fair to say that there was no need for the spur of outside criticism to make generation authorities give priority attention to good combustion conditions. But that independent survey does assist in the realisation of good intentions that are already present.

UNCLE TOM COBLEIGH AND ALL-ELECTRIC

The well-known song suggests that the Cobleighs were a large family but over the years they appear to have had little effect on the growth of population at Widecombe-in-the-Moor. Now, the absence of an electricity supply is being blamed for what some say is a dying village and quite a storm has been raging over Dartmoor on this issue. Summer visitors to Widecombe, remembering the tourist attraction of teas and souvenirs, may join issue on such a view and take sides with the Dartmoor Preservation Society. However, the South Western Board has now taken up the role of peacemaker and given a tentative promise of a supply by 1962 with full agreement on the conflicting problem of amenity. It will cost some £38,000 to bring supply to 180 prospective consumers. Shorn of the sentiment attached to its name, electrification of this village is typical of the uneconomic development in rural supplies that boards are carrying out. And it won't knock a ha'penny off the price of the souvenirs.

This week's quick summary of electrical news faces advertisement page 20.

Micro-machine studies at Imperial College

by B. Adkins, M.A., D.Sc.(Eng.), M.I.E.E.*

As the size and complexity of the power system used to supply electrical energy increase, it becomes more important to understand fully its operation under all conditions. For normal operation under steady conditions, the quantities in the system can be readily determined by a steady-state load study on a network analyser or a digital computer. For transient conditions, however, the theoretical basis is much less firmly established and a dynamic model is very useful for studying the behaviour of a large system.

Important installations of model power system equipment have been made in recent years in Russia and France.[1,2] Some of these installations consist of small machines and other equipment provided with adjustable features so that they can be set up to form a model of any section of an actual or proposed system. Alternatively the model may be built to represent a particular system. The equipment can be used to simulate any operating condition in the power system but hitherto the models have been of particular value for studying stability problems. The most important application has been to check the transient stability of systems supplied by hydro-electric generators through long transmission lines. However, the problem of steady-state stability in heavily loaded systems supplied by steam turbo-generators is of increasing importance. Both of these problems are of very great interest to British engineers, because, although most of the power at home is produced in steam stations, a great deal of hydro-electric equipment is exported for use abroad.

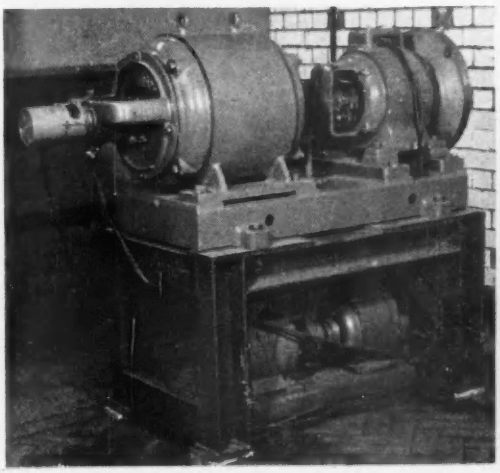
In recent years full-scale tests[3,4] have been carried out on the British system in order to obtain information about its transient performance. It has been demonstrated, for example, how a continuously acting voltage regulator can be used to increase the stability margin of a given generator. It has also been shown that it is feasible to allow an alternator which pulls out of step to operate asynchronously for a time while action is taken to restore synchronism. The purpose of the research programme with which the author is concerned at Imperial College is to study these and similar problems under conditions where there need be no anxiety about disturbing the system or damaging the machines. Some of the results, with a full theoretical analysis, are presented in two papers recently published.[5,6] A summary of the results is given in this article.

Installation at Imperial College

The model equipment is a combination of many components, the most important being the micro-alternator sets, one of which is shown in Fig. 1. The items of the installation are not by any means exact physical models of their counterparts in the large power system. The guiding principle is that the parameters, when measured on a per-unit basis, must be equal to those of the full-scale system—in other words, the equations governing the operation of the two systems must be the same.

Micro-alternator.—The micro-alternators are four-pole machines normally rated at 230 V, 3ph, 50 c/s, 1,500 r.p.m., 2 kVA. The large machines they simulate may, however, be two-pole steam turbo-generators or 60-pole water turbine generators. The parameters to be simulated in the model include the synchronous and transient reactances and time constants, the resistances of all the circuits and the inertia constant.

* Dr Adkins is at Imperial College. In preparing this article he has made use of some of the information and diagrams in his papers (with other authors) first published in the *Proceedings of the Institution of Electrical Engineers*, 1960. (References 5 and 6, on page 8.)



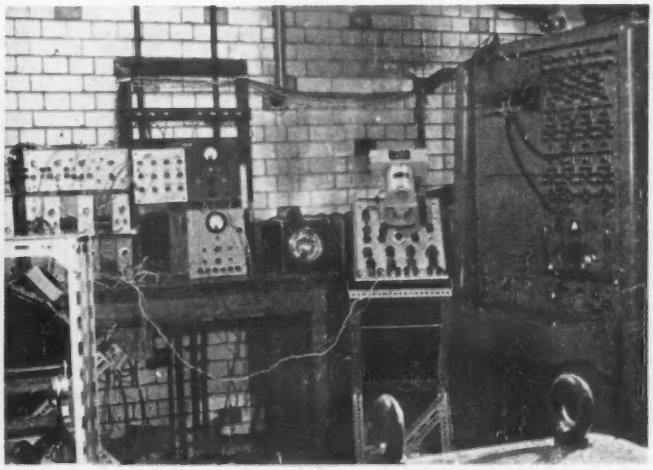


Fig. 1. (left). The micro-alternator set and its exciter set. Fig. 2 (right). Section of the machines laboratory at Imperial College, showing a voltage regulator simulator and a control panel

The per-unit resistances of a normal small alternator are much higher than those of a large machine, but the micro-alternators are of a very special design with abnormally low resistances. They are, in fact, of appreciably larger physical size than a commercial 2 kVA machine. In the field circuit there is an electronic negative resistance which can be used to reduce and adjust the effective field resistance. An adjustable flywheel provides any desired value of the inertia constant.

Two micro-alternator sets are available in the laboratory. In order to obtain a wide choice of parameters, there are two stators of different design and five interchangeable rotors, all different. Moreover, the damper bars can be removed or replaced, and further variation of the per-unit parameters is obtained by changing the voltage level or the base load.

Micro-turbine.—The model of the turbine is a separately excited d.c. motor, which has a special thyratron regulator, controlled to make the torque-speed characteristics of the motor correspond to those of the turbine.

Tacho-generator. — A two-phase, four-pole tacho-generator is coupled to the alternator. The angular position of the rotor and hence the phase of its voltage can be adjusted.

Voltage Regulator Simulator —Any form of regulator for automatic control of the alternator excitation can be readily simulated. The laboratory equipment consists of adjustable amplifiers and delay elements which can be set up to simulate a regulator of any type. Fig. 2 shows a view of a regulator mounted on the laboratory bench. On the right is one of the control panels containing auxiliary apparatus associated with the alternator.

Governor Simulator.—The governor is simulated by a regulating system, mainly electronic, by means of which a speed signal taken from the tacho-generator is used to control the micro-turbine.

Micro Power System.—The equipment described above, which is already in being, has been used mainly for investigations requiring a single alternator, often operating in conjunction with a fixed supply and an external impedance to simulate a transformer or transmission line. Additional equipment is being developed so that a "three-machine system," comprising two alternators, a fixed supply and a power network, can be simulated.

Special Measuring Equipment

During any transient operation, the instantaneous torque produced by the alternator and the "load angle," which defines the position of its rotor, are quantities of decisive importance. Special apparatus has been developed in the laboratory for recording these two quantities.

Torque Meter.—A direct measurement of the transient torque is difficult on a large machine, but is more feasible (although still not easy) on a small model. The special torque coupling, shown in Fig. 3, was constructed for mounting between a micro-alternator and its driving motor. The torque is transmitted through a thin tube on which are mounted four strain gauges in bridge connection. The strain gauges are cemented to the outer surface of the tube so that their axes lie along the lines of principal strain, which are at 45° to the axis of the tube when it is subjected to torsion (see Fig. 4). The signal output from the bridge is then proportional to the torque in the coupling.

The main difficulties arise from the very small magnitude (of the order of a millivolt) of the voltage signal, and from the necessity of making connections to the measuring apparatus through slip-rings. In order to reduce the relative importance of the disturbance due to the slip-ring contacts, a special self-contained transistor amplifier (Fig. 5) was constructed for mounting inside the torque coupling. The torque meter has proved very satisfactory for recording with an oscilloscope the rapidly oscillating torque developed after a sudden short-circuit. For other purposes, when the slowly varying mean torque is the important quantity, it is easy to filter out the rapidly oscillating component.

Load Angle Meter.—Measuring equipment was also developed for recording the transient variation of the load angle δ of the generator. The method adopted makes use of a sharp pulse generated at the instant when the voltage of the a.c. tacho-generator passes through zero. The pulse modulates the beam of a cathode ray oscilliscope which traverses a periodic saw-tooth pattern produced by its normal time base circuit along the X-axis. The record is taken by a camera in which the film moves in the Y-direction. If the beam were continuously illuminated, the saw-tooth pattern, which is triggered by a pulse generated from the terminal voltage, would be recorded as shown in Fig. 6. Since, however, the beam is sharply modulated, only the points show at the instants corresponding to the load angle δ. Hence the dots following the curve A give a record of the transient load angle.

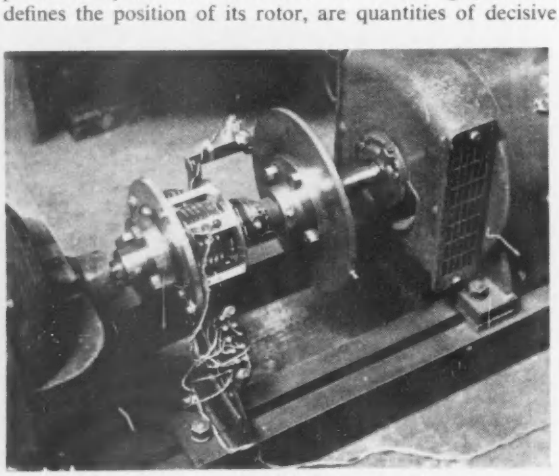


Fig. 3. Torque coupling mounted between micro-alternator and its driving motor

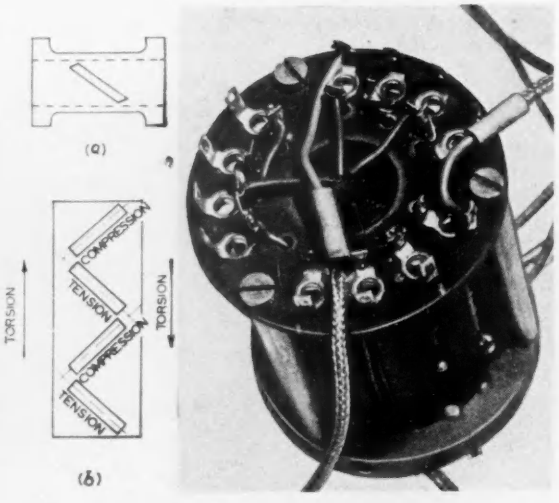


Fig. 4 (left). Torque tube with strain gauges: (a) plan view; (b) developed view. Fig. 5 (right). The transistor amplifier for mounting inside the torque coupling

Application of I.C. Installation

The research work carried out in a university department should be concerned with fundamental principles rather than with the solution of day-to-day problems. The research should, in fact, be directed towards the problems of the future. This point of view has been adopted in determining the programme of work at Imperial College.

Since the practical developments of the future will depend on the advancement of theoretical knowledge, the primary object of the research work is to consolidate existing theories and to develop new ones. Each project is envisaged as a combination of theoretical (often mathematical) study and experimental verification. The experimental work not only verifies the theory but provides important pointers for its development. Both the theoretical and experimental sides are essential for any worth-while progress.

The general equations of the synchronous machine were worked out by R. H. Park as early as 1929,[7] and have since been developed by many workers. A collected statement of the equations is given in Ref. 8. These equations provide the basis for all the investigations mentioned in this article. The mathematical derivations, on which are based the calculated curves shown in Fig. 7 to 15, are given in Refs. 5 and 6.

Short-circuit Problems.—Symmetrical and unsymmetrical short circuits of alternators have received a good deal of attention in the literature, but the theories relating to the torque developed after the short circuit have not hitherto had full experimental verification. Some investigations carried out with the micro-machines have served to supplement the earlier work.

The curve showing the variation of the torque in the shaft between an alternator and its prime mover after a sudden short circuit is a complicated wave. It contains pulsations at supply frequency and at double supply frequency, and there is also a component which depends on the natural frequency of the mechanical system.

In Fig. 7(a), the full line shows the variation with time of the shaft torque, after a three-phase short circuit at full voltage, calculated mathematically from the equations. The dotted line shows the measured curve transcribed from the oscillogram shown in Fig. 7(b). Fig. 8 shows the torque after a single-phase short circuit and demonstrates how resonance in the mechanical system can influence the results. The investigation showed how dangerous stresses may arise in the shaft under short-circuit conditions, and how their magnitudes can be predetermined.

The rapidly alternating torques do not appreciably affect the speed of the machines, but there is also a slowly varying component of torque which does cause the speed to change. The load angle meter was used, in conjunction with the torque meter, for an investigation which showed how the slowly varying torque affected the speed of the machine after the short circuit. If the generator is loaded before the short circuit, the prime mover torque causes the set to accelerate when the generator torque is reduced. During a short period immediately after the short circuit, however, the losses due to the heavy currents are sufficient to cause a dip in the speed curve. The effect is best shown by the curves of Fig. 9, which give the variation of the rotor angle δ with time. The dotted line shows the measured angle, and the full line (a) is a calculated curve obtained by solving the differential equations applicable to this condition. The dip in the calculated curve is much smaller than that in the measured curve. In calculating curve (b) an allowance was made for additional stray losses.

Synchronising and Damping Torques.—The torque and angle meters were used to measure the synchronising and damping torques produced in a synchronous machine oscillating about a mean synchronous speed. The results are important, for example, in connection with the forced oscillations set up in Diesel-driven alternators. For each

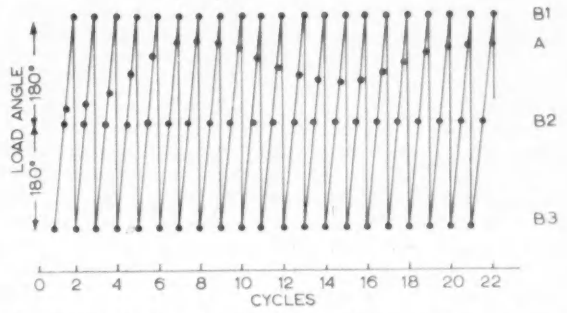


Fig. 6. Method of recording the transient load angle; modulation of the c.r. beam gives a pattern of dots as at A

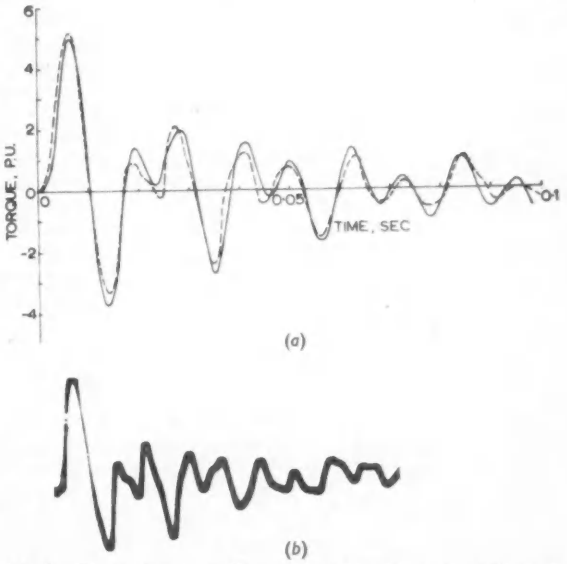


Fig. 7. Transient torque after a three-phase short circuit (a, top). Shaft torque: broken line, measured values; full line, calculated. (b) Oscillogram of shaft torque

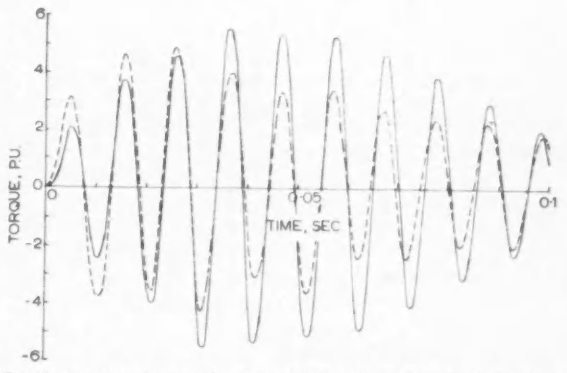


Fig. 8. Transient torque after a single-phase short circuit. Broken line, measured; full line, calculated

measurement the machine was caused to oscillate at an angular frequency m, and oscillographic records were taken of the sinusoidal variations of torque and load angle. From these curves the values of the elastic co-efficient K and the damping co-efficient C were determined. Fig. 10 shows the measured and calculated values of K and mC for different values of the mean load angle δ_o. These co-efficients can be used to calculate the angular deviation caused by any given applied torque pulsation.

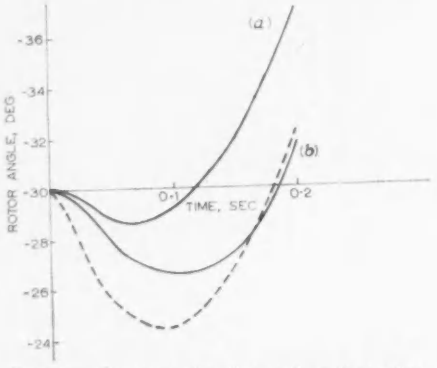


Fig. 9. Variation of rotor angle after a three-phase short circuit; (a) Calculated; (b) Full line, calculated with allowance for stray loss, broken line, measured

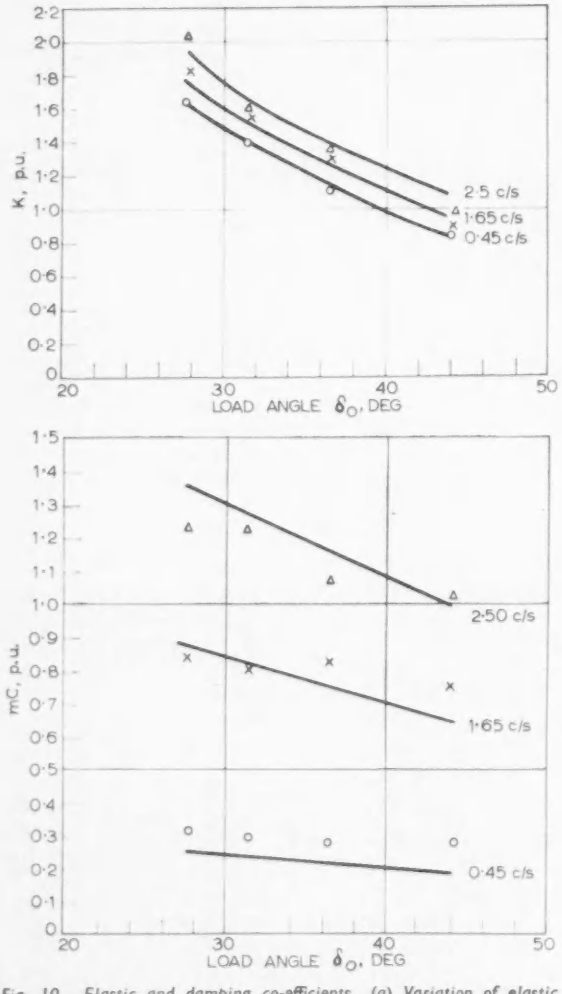


Fig. 10. Elastic and damping co-efficients. (a) Variation of elastic co-efficient K. (b) Variation of mC (C is the damping co-efficient.) Calculated curves are shown as full lines. Test points: circle, 0·45 c/s; cross, 1·65 c/s; triangle, 2·50 c/s

Swing Curves following a sudden Change of Reactance. —The problem of transient stability can be studied by

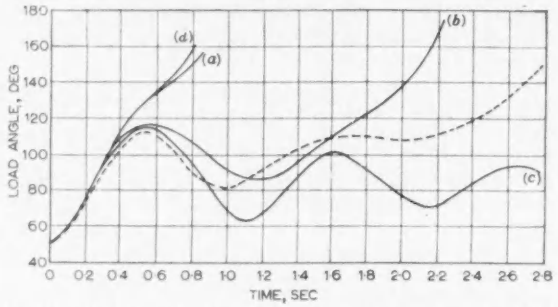


Fig. 11. Variation of load angle after inserting a reactance. Broken line, measured; full line, calculated. (a) Assuming constant flux linkage and no damping. (b) Allowing for variable flux linkage and damping. (c) Allowing for damping but assuming constant flux linkage. (d) Allowing for variable flux linkage but assuming no damping

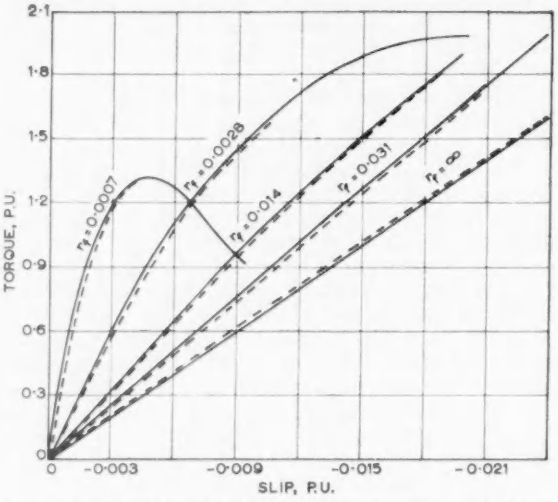


Fig. 12. Torque-slip curves (machine unexcited but field circuit closed). Broken line, measured; full line, calculated

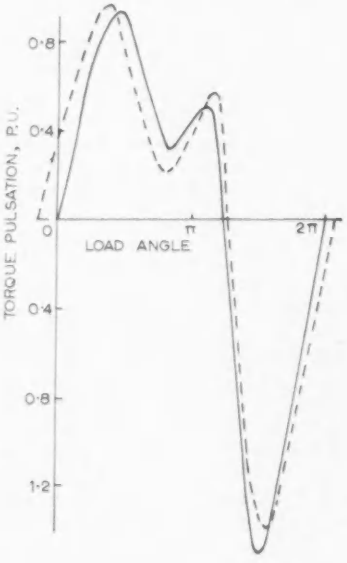


Fig. 13. Variation of torque with load angle (machine excited). Broken line measured; full line, calculated

considering the simple case of a generator connected through a reactance to a fixed supply. If the reactance is suddenly increased, the generator rotor swings and, depending on the severity of the change, may either return to a stable condition or may pull out of step. A detailed theoretical study has been made of this condition and the results have been verified by tests on the micro-machines.

Earlier methods of dealing with this problem have been based on a number of different assumptions. The investigation examined the theoretical basis and the practical effects of the various assumptions. Fig. 11 gives several curves, calculated by alternative methods, showing the load angle as a function of time for a condition where the value of the reactance introduced was large enough to cause the generator to fall out of step. The dotted curve shows the measured variation of the load angle with time. Curve (a) is calculated by the commonly accepted method based on the assumption of constant field flux linkages. Curve (b) is calculated by a more exact method which allows for varying field flux linkages and for damping. Curve (c) applies when the flux variation is neglected, and curve (d) applies when the damping is neglected. It is clear that the methods which neglect damping are inadequate when operation over a relatively long period is in question. On the other hand, curve (c) shows that, if damping is included, but field flux variation is neglected, the system would be shown to be stable when it is actually unstable.

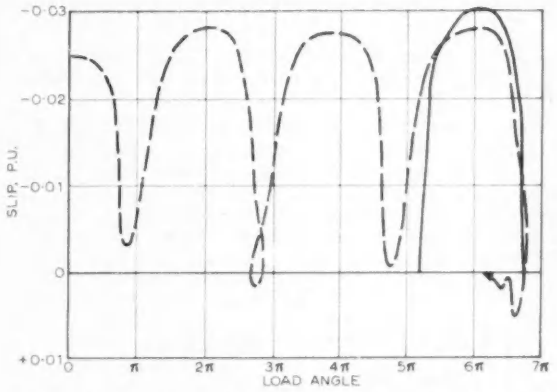


Fig. 14. Variation of slip with load angle (machine excited). Broken line, measured; full line, calculated

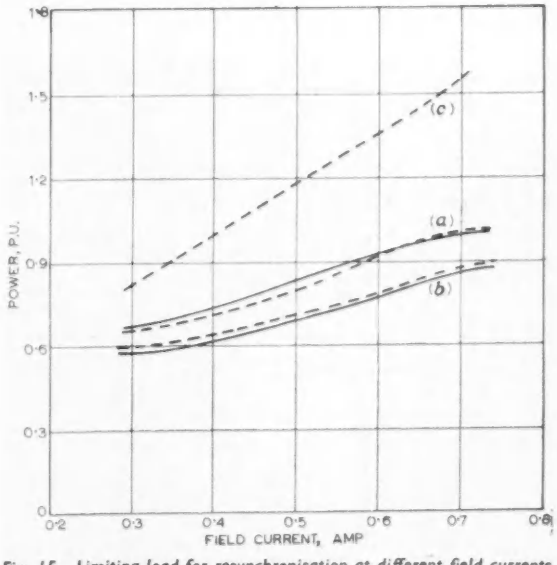


Fig. 15. Limiting load for resynchronisation at different field currents. Broken line, measured; full line, calculated. (a) Inertia constant H = 5·1 sec. (b) Inertia constant H = 8·0 sec. (c) Shows the load at which the machine pulls out if already in synchronism

Asynchronous Operation.—If the field voltage is removed, an alternator may operate as an induction generator at a speed slightly above synchronism. However, because of dissymmetry in the rotor, the speed and torque are not constant but pulsate at twice the slip frequency. The stator currents are modulated at the same frequency If an exciting voltage is applied to the field the pulsations become more severe. When a large alternator pulls out of step for any reason, the stator current increases and, in general, the conditions are such that they can only be tolerated for a short time. If, however, the machine can be resynchronised quickly, it may be possible to avoid taking it out of service. It is thus important to understand as fully as possible the conditions which determine the performance of the machine away from synchronism.

Theoretical methods have been developed for calculating the mean values as well as the periodic variations of the torque and the slip when the synchronous machine is operating asynchronously. Fig. 12 shows the torque-speed characteristics (mean torque and mean slip) with different values of field circuit resistance when the alternator is operating without excitation as an induction generator. Fig. 13 shows the transient variation of the torque during a slip cycle when the alternator is excited. The main pulsation of this curve is due to the excitation while the second harmonic component is due to the rotor dissymmetry.

Resynchronisation.—If the pulsation of the slip of an alternator running out of synchronism is sufficient to bring the value of slip right down to zero the machine is likely to resynchronise. Fig. 14 (dotted line) is a measured curve showing such a condition. During the first three cycles shown the generator just fails to resynchronise but does so at a fourth attempt. The calculated curve (full line) indicates that the slip comes down to zero. It is, therefore, possible to derive an approximate criterion for resynchronisation, depending on whether the calculated minimum value of slip is negative or positive. The full-line curves of Fig. 15 are calculated in this way for two different values of the moment of inertia.

Curves (a) and (b), shown dotted, were measured by finding the minimum field current needed to pull the machine into synchronism. Curve (c) shows the power at which the generator falls out of step if already in synchronism.

Other Problems.—The results summarised above relate to problems for which the investigations have already led to definite conclusions. Active work is proceeding with the micro-machine equipment, both by pursuing further the subjects discussed here and by investigating other related topics. Among the problems at present being studied are the following:

1. Measurement of the operational impedances of the generator, with particular reference to the effect of solid iron material in the rotor.
2. The effect of voltage regulators or other forms of excitation regulator on the stability of the system.
3. The effect of speed governors or other forms of turbine regulator on the operation of the system.
4. Special control methods for obtaining large power outputs for short periods.

Concluding Remarks

The investigations carried out with the micro-machine equipment provide a good example of the kind of research work in the field of electrical power engineering that can be usefully pursued in a university laboratory. The most suitable problems are those, which, requiring a high standard of theoretical and experimental work, lie a little beyond the immediate practical requirements of a commercial organisation, although having great practical importance for future development. Much of the work is done by post-graduate research students, who obtain in the process a valuable insight into the methods of applying scientific principles to the study of practical problems.

Acknowledgement

The work recorded in this article is supported by the Research Council of the Central Electricity Generating Board, to whom grateful acknowledgement is made. The author also wishes to thank Mr C. J. Carpenter for his valuable help in developing the equipment.

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Progress with "Solidal"

ALTHOUGH it is only a little over 12 months since the first information on the all-British development, "Solidal" cables, was released—they were first reported in these pages in June last year—a number of small but highly successful installations both here and on the Continent are now in service and others are in course of manufacture.

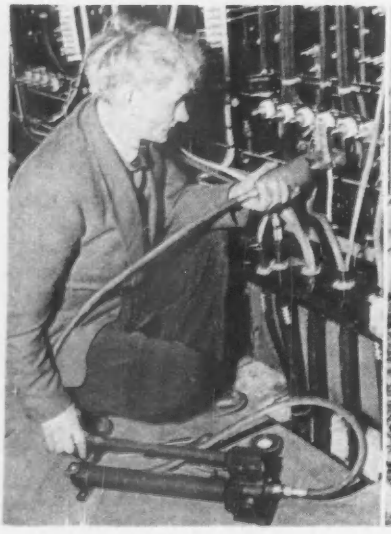
The centre photograph below depicts the laying of about 250 yd of 250 amp "Solidal" cable in an open trench by the electricity authority in Parma, Italy, and we understand that a further installation, this time of 300 amp cable, will be going into service shortly.

The jointing of this cable was by normal aluminium soldering techniques, but at Rogerstone, in the Northern Aluminium Co.'s works, more than 1,500 yd of "Solidal" cable is in service and both mechanically crimped and soldered joints have been used according to the particular location. At Banbury, the Midlands Electricity Board have installed some 250 yd of 250 amp "Solidal" cable in the works of Aluminium Laboratories Ltd., most of which has been laid direct in the ground.

Among factory installations there is news of about 100 yd installed in a Swiss factory and 30 yd of 100 amp cable in the new Solartron factory at Farnborough, each being an initial experimental installation with a view to further cabling if satisfactory.

Electricity boards are taking an interest in "Solidal" and the remarks of the Midland Board after installing the Banbury run are revealing. They say that the entire time for pulling in the cable, including stops for photographing, was 30 min as compared with about 1½ hr for a similar p.i.l.c.a. cable.

Many of the leading cable manufacturers are now in a position to manufacture and supply "Solidal" to order and a booklet on the properties of the cables is available on request from the Northern Aluminium Co., Sales Development Division, Banbury, Oxon.



Compression jointing a termination on "Solidal" cable at Rogerstone

250 A "Solidal" cable being laid at Parma, Italy

Installing a 250 yd run of 250 A "Solidal" cable at Banbury

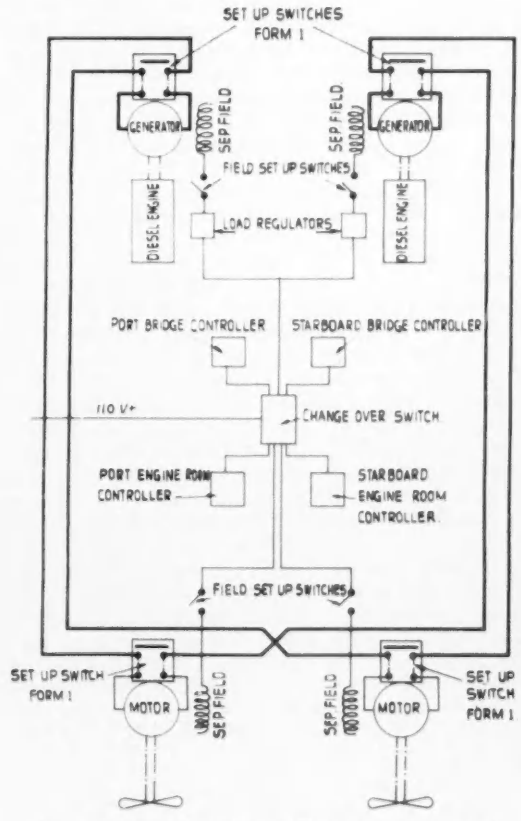
Diesel-electric marine tug

PROPULSION EQUIPMENT ON THE "LLANWERN"

THE 95 ft diesel electric tug "Llanwern" which has just been delivered to the British Transport Commission by the builders, Messrs P. K. Harris of Appledore, at Newport, Mon., is a twin screw vessel driven by two 550 h.p., 1,250 r.p.m., 440 V d.c. propulsion motors coupled, through "Modern Wheel Drive" reduction gear boxes, to the 210 r.p.m. screw propellors at the full speed of 12 knots. The motors, in turn, derive their current from two 1,000 A, 440 V d.c. generators coupled to 660 h.p., 750 r.p.m. Lister Blackstone eight-cylinder diesel engines.

Control Circuit

The two main generators and propulsion motors are connected in a series loop with "set-up" switches to cut out either generator or motor as shown in the diagram below. Excitation of the motor and generator fields is derived from the ship's d.c. supply system which is, in turn, derived from two 4 kW auxiliary generators on the main diesel engines or a separate 18 kW harbour set. The speed regulation and reversing is by adjustment of the motor fields in a modified Ward-Leonard system, the motor field rheostats being operated by a cam controller which simultaneously alters the related generator field so preventing feed-back of power from the motors to the engines when going from full-ahead to full-astern. Separate controllers for port and starboard motors enable each to be reversed or controlled independently. Failure of a diesel unit still permits the two propulsion motors to be run from a single generator.

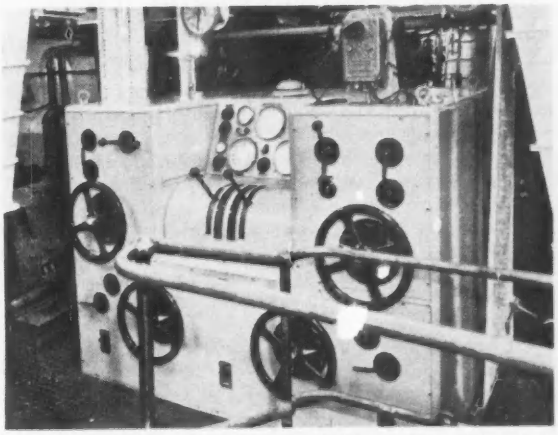


Schematic layout of the electrical circuit on the "Llanwern"

Engine controls and interlocks are centralised at the engine room console which is in touch with the bridge by the usual engine-room telegraph but speed control and reversal of either propulsion motor can also be effected direct from the bridge. A special load control feature is a device which determines the load on the engine, as sensed through the governor, and, by adjusting the field rheostat to suit, prevents overload either with a normal or a faulty engine and also automatically matches engine loading and generator working to the differing conditions of high "bollard pull" or "free run".

This system, which has been devised by the Brush Electrical Engineering Co., who provided the motors, generators and control gear, enables the engine power to be utilised to the best advantage under all operating conditions whether it is derived from a single or both engines. Moreover, it requires no special skill in handling as the correct conditions are set up automatically and safety interlocks prevent such mishandling as changing the "set-up" switches with the motors or generators excited. The minimum speed of steady operation is 10% as compared with 30% for plain mechanical drive and there are ten steps of speed control on each motor. Reversal from full-ahead to full-astern in a single movement can safely be applied, the time for the propellor to fully respond being about five seconds.

Total bollard pull with one engine is ten tons and with two, 18 tons. Free running speed with one engine alone is 10·4 knots, sufficient for all but the exceptional case.



The control console in the engine room which incorporates all interlocks

Readers Views

Correspondents writing under pseudonyms are asked to submit their names and addresses in confidence to the Editor

Earthing to Water Mains

AS a water engineer, I should like to comment on *Meteor's* reference to a Staffordshire water board's "request" that the earthing of electrical equipment to water pipes should cease. He says that the reason the step has been taken is "somewhat obscure."

There are a number of good reasons why earthing to water pipes is undesirable. First, it is often necessary while changing a water meter or replacing a consumer's stop-cock to disconnect a joint or joints in the service pipe. If, when this is being done, an insulation fault exists on the consumer's electrical equipment and the effective earth is situated on the mains side of the disconnection in the service pipe, it is possible for the consumer's pipework and the service back as far as the disconnection to be "live." This condition, as your readers will readily appreciate, would not be very healthy for a plumber who may be working in damp surroundings.

Secondly, where copper or copper alloy service pipes and fittings are used, a certain amount of copper oxide often exists at pipe joints, particularly at those of the manipulative type, thus forming a copper oxide rectifier. This may be a very inefficient rectifier by electrical engineering standards, but, nevertheless, a d.c. component is imposed on any leakage current which may exist and electrolytic corrosion of the water service can result.

Thirdly, increasing use is being made of cathodic protection for water mains. For this purpose, it is necessary for impressed current economy to keep any possible sources of leakage of this current to a minimum. Insulation of the mains from other metallic equipment is, therefore, resorted to. This measure is likely to decrease the effectiveness of any water service pipe as an earth without the consumer being aware of the fact.

In the course of their duties water engineers are generally responsible for much electrical equipment and they are well aware of the necessity for its proper earthing. At the same time, they are also cognisant of the shortcomings of their mains and services for earthing purposes. They are, therefore, not likely to seek the prohibition of earthing electrical equipment to their installations without good technical reasons.

A. Smith, B.SC., M.I.C.E., M.I.W.E.,
HOWARD HUMPHREYS AND SONS,
LONDON, S.W.1.

E.A.W. Questionnaire

I AM glad that *Peregrin* has devoted so much space to the EAW "Viewpoint" questionnaire in the ELECTRICAL TIMES for 23 June, for it gives me the opportunity to state that the purposes of this inquiry are to focus attention on the whole question of electrical equipment for the modern home and to stimulate thought and discussion among users and suppliers alike, in the hope that the result will be even greater benefits for the users in their individual household circumstances.

The EAW's basic aim is education of its own members and of the public, and the meetings on the "Viewpoint" theme arranged by many of our 200 branches have been a means of encouraging interest in the all-electric home. A further educational advantage has been derived by all those individuals who have answered questions in the survey, since thought and judgment have been involved and knowledge of alternative methods and means has been acquired.

As for the results of the survey, the EAW hopes they will be studied by all who are interested in giving the user the very best form of installation and equipment the British electrical industry can provide and this, of course, includes the supply authorities, manufacturers, contractors and retailers of all kinds. As electricity is perhaps the greatest service which the modern home receives, the Association is rightly concerned not only with the initial installation of wiring and apparatus, but with continued maintenance, so that 100% efficiency can be achieved at all times. It recognises the difficulties of after-sales service, but this is a problem common to many industries and one which should not be shelved if an initially satisfied buyer is to remain a continually satisfied user, and it is the user's interests which the EAW has always at heart.

It is, of course, appreciated that the customers are not always right, particularly when their opinions are based on insufficient knowledge of what is available or of what is practicable from a technical or economic point of view. Nevertheless, manufacturers have made it clear that they welcome the considered opinions and criticisms of the user which arise from day-to-day use of any article. They may not meet criticisms in the exact way suggested, but, with their developing technical resources, they can often provide a solution in a modified design or even in a new appliance.

Peregrin refers to the BEAMA's request to the EAW to ascertain its members' views on the size of boiling plates. More than two-thirds of the members who replied were content with the plates provided on their cookers. Faced with the choice between 8 in. and 6¼ in. plates, almost four times as many preferred the larger size plates, and these are now provided.

In considering those bodies concerned with the modern home whose work ultimately benefits the householder, we must also look beyond the electrical industry to architects, builders, and the housing and town-planning authorities, all of whom showed exceptional interest in the previous EAW survey. A home that is well-planned and well-wired at the outset obviates many later problems.

The EAW is aware of many things, but before it can take action or stimulate action by others it requires to have more concrete evidence and this it is hoped the "Viewpoint" survey will supply. The information gained from the survey will be made generally available in a published report in due course.

Mary George, M.B.E.,
DIRECTOR, ELECTRICAL ASSOCIATION FOR WOMEN,
LONDON, W.1.

THE COCKTAIL PARTY EFFECT

The ability to hear speech above a babble of voices is an essential requirement for every participant at a cocktail party. This discriminative ability by a biaural listener has now been reproduced electronically by the Bell Telephone Laboratories. For this the outputs of two microphones were cross-related to generate a gating wave which was applied to the combined output of the microphones. This raised the intensity of the combined signal only when energy from the desired voice arrived simultaneously at both microphones. This early experiment shows the possibility of machine reproduction of elementary properties of human hearing.

CIGRE 1960

Extra High Voltage Systems
Overhead Line Conductors

Differences of opinion as to the next step in transmission voltages for extra high voltage systems were expressed at CIGRE. They are referred to in our continuing report of the e.h.v. and overhead lines discussion groups.

Extra High Voltage

IT was clear from the number of contributors to the discussion that the operation of extra high voltage was a subject of immediate concern to power systems' engineers in many countries. Introducing the subject, the chairman, MR PH. SPORN (USA), drew attention to the increase in world power requirements which were doubling every ten years. To meet this need, power systems design must be dynamic and based on probability of extension at some future date to higher powers and voltages. Fundamental investigations were needed into all aspects of the subject from ways of increasing size and speeds of generating units to the development of new materials for higher temperature and pressure operation. As exhaustion of local power sources progresses the emphasis must be more and more on development of long transmission lines for bringing power from remote sources.

This year's conference concentrated on two aspects of high voltage systems, the desirability or otherwise of specifying international standard system voltages above 400 kV, and consideration of operational problems on long, high-voltage lines, particularly with reference to stability. Although most speakers seemed to be in favour of some form of international standardisation, it soon became clear that there was considerable difference of opinion, perhaps irreconcilable, about what the standard voltages should be.

Which Voltage?

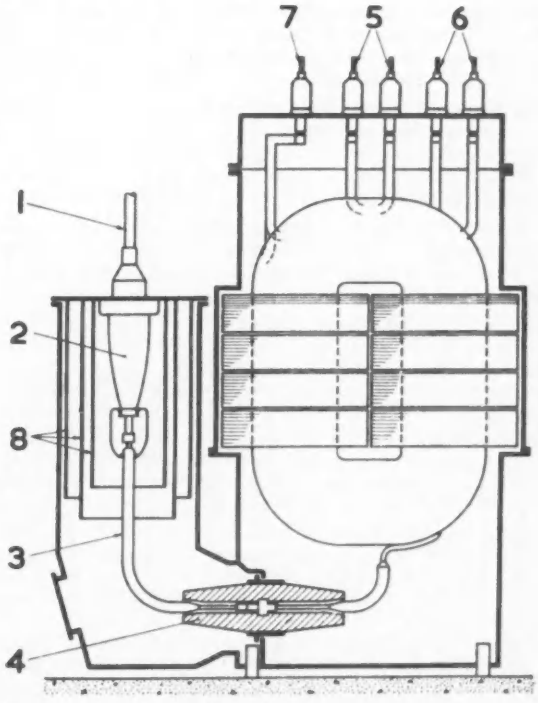
For the first step, the USA, Britain and Japan had used 275-287 kV with 300 kV max., while most European countries, and temporarily the USSR, had preferred 380-400 kV with a maximum of 420 kV. In Russia, at least, they were now considering raising this level to 500 kV generally, to give more economical transmission of large powers over long distances. In addition, there were other systems which might be considered as operating at a maximum voltage of 362 kV. There were thus, at present, four voltage levels in use in the world as the next step above 245 kV, despite general agreement that such a number of voltages was uneconomical, particularly from the point of view of the manufacturer. It was, however, true that the optimum ratio between steps was not clearly defined depending as it did on load arrangement, distribution system and the rate at which consumption increased.

Two main proposals for voltage steps have emerged from this session's reports. SPORN and ST. CLAIR (USA) suggest 345 kV, 500 kV and in the distant future 690 or 750 kV, and, in addition to these, special systems might prefer two steps of either 138 and 345 kV or 230 and 700 kV, converging at the next highest voltage of 690 or, even better, 750 kV. On the other hand, MR AILLERET (France) supported the IEC scale of 245, 300, 420 and 735 kV maximum at each level. This proposal also received the backing of a report covering a detailed analysis of the German system's choice of 380-420 kV.

Strong support was given to the American suggestion by MR JANCKE (Sweden) who said higher insulation levels were of great importance to manufacturers and emphasised the difference between problems of long distance bulk transmission and those of closely interconnected networks. For long lines it would be difficult to restrict voltages in the range 400 to 700 kV, while for interconnected systems, larger voltage steps would reduce the number of transformers and reactors required.

The conflicting problems of short system life with small voltage steps and the technical difficulties to be overcome in going to higher voltages were mentioned by MR ROSER (Germany). He referred to good security and safety in a growing pollution problem experienced with the 380-400 kV system and thought this was the one for Western Europe, with 660-690 kV as the next step; 500-550 kV had been shown to be unsuitable for Germany.

Drawing a distinction between conditions in Europe



Tumut I power station, 56 MVA, 190 kV single phase transformer, with cable box for withstanding constant pressure of 110 lb/sq in. 1, cable; 2, oil-immersed cable termination; 3, removable link; 4, through-tank bushing; 5 and 6, terminals for low-voltage windings; 7, terminal for high voltage neutral; 8, insulating barriers

and the USA, MR WAGNER (USA) said that the problem in Europe was, in general, bulk transmission of power over long distances, while in America the need was for a system overlaying existing networks which had outgrown their capacity. For this purpose 345 kV had been chosen and future probable steps were 485 and 525 kV.

Agreeing with MR AILLERET's comments on the present chaotic state of e.h.v. system, voltages and the possibly disastrous consequences of further lack of standardisation, MR CASSON (GB) pointed out that it was only ten years since 275 and 380 kV were standardised and now both Russia and Sweden were uprating these lines to 500 kV.

In general, optimum design had some slack which could often later be exploited by raising the voltage level of a system. He said it seemed that two steps above 225 kV could be achieved and it looked as though we shall have to have five levels. "Slack" in system design was also the basis of MR KENOUSSE's (USA) remarks on reconductoring of the Los Angeles 280 kV line for 380 or 400 kV without altering insulation.

Factors affecting the choice of system voltage were dependent on how quickly a system could be expected to reach full capacity and especially the influence in the early stages of capital cost required—which could be decisive; the technical ability of a country's manufacturers and the time which could be devoted to examining system performance at voltage level on which no experience was available. In making these points, MR DIESENDORF (Australia) said he thought it unrealistic to specify a voltage of 700 kV before thorough investigation, and suggested that in many cases an intermediate step between 400 and 735 kV may be advantageous.

The discussion served to emphasise the many factors to be considered in selecting higher transmission voltages and the divergence of views between different countries. MR CAHEN (France) commented that evolution of transmission systems was very rapid and he hoped that all those with means for research on higher voltages would investigate the variety of problems of transmission. Concluding the discussion, the chairman, MR SPORN, said that CIGRE had established a small study group to examine aspects of the problem and to suggest actual voltage levels which might be recommended.

Network Stability

Sufficient is known about network stabilisation under both steady-state and transient conditions to solve problems at low voltages, but there remain several features of h.v. line operation still to be resolved. Series capacitors and high speed auto-reclosure were discussed, and the extent to which steady-state stability tended to outweigh the limitations imposed by transient stability.

Experience of the Swedish network suggested that series capacitors were the most efficient way of obtaining stability since the series compensation could be correlated with conductor cross-section to give an optimum relationship while maintaining maximum power transmitted slightly below the stability limit. MR LALANDER (Sweden) mentioned that series capacitors were a cheaper way of increasing system capacity than raising the insulation level, but he added that if Sweden were now designing a new network they would go a voltage higher than 400 kV.

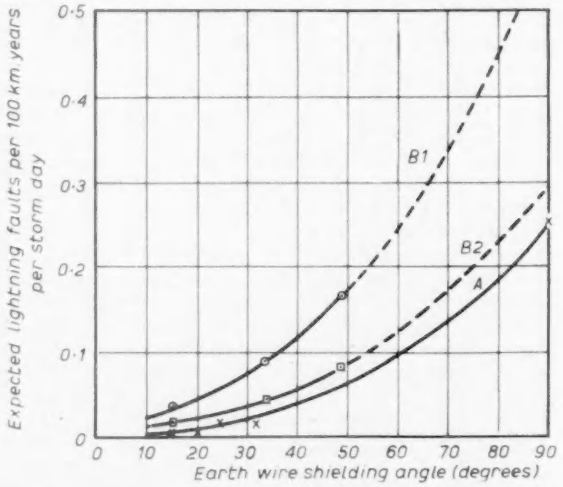
MR MAMIKONJANTZ (USSR) thought that in many cases series capacitors were adequate. Work in the USSR on transient and steady-state stability has included investigation of excitation control using armature current and rotor angle first and second derivatives. Dynamic braking was also being tried. Series capacitors were being installed in the centre of two single lines linking Kuibishev to Moscow. These lines were about 800 km long and operated at 400 kV. However, on rather longer 500 km lines connecting to the Urals and Stalingrad, neither series capacitors nor synchronous condensers were in use. MR LEBEDEF (USSR) commented on the successful way in which these new lines had been brought into operation at 500 kV. Auto-reclose had operated well on these lines for over-voltage protection.

Increasing speed of auto-reclosure on transient faults seemed to receive general approval, but there were fundamental differences of opinion on the relative merits of three-phase as opposed to single-phase auto-reclose. For three-phase auto-reclosure MR ST CLAIR (USA) thought it desirable to reduce dead time as much as possible consistent with deionisation. They had found that a persistent fault was not unduly harmful, and by using a positive sequence relay system it was possible to prevent reclosure on large faults. A total dead time of 4 c/s on a 60 c/s supply had recently been reduced to 3 c/s with improved breaker operation; 93% satisfactory clearance was claimed on these three-phase auto-reclosers, and American opinion was not able to justify the relatively high increased cost of converting their oil breakers to single-phase reclosing. This conclusion was supported by Norwegian engineers, but was not the general conclusion in Scandinavia, for Sweden favoured single-phase reclosure, at least on air-blast breakers, although MR NORLIN added that their service was restricted to about 150-mile length because of secondary arc effects. It was intended that single-phase auto-reclosure would be used on new 200 km radial lines in Southern Sweden.

France also preferred single-phase auto-reclosure and it was likely that reclosure times would be reduced to 0·03 second depending on system analysis. High-speed auto-reclosure on one-phase was also in use on Australian 330 kV lines. In Belgium, MR RENCHON claimed that single-phase reclosure had given excellent performance, enabling stability limits to be increased considerably and at little extra cost. MR CAHEN commented that, once again, economic considerations seemed to be the governing factor, although it appeared that single-phase reclosure was to be preferred on long lines.

Faults on E.H.V. Lines

A valuable report by MR CASSON (GB) analysed the fault records of 73 circuits operating at above 225 kV.



Relationship between lightning faults and earth wire shielding angle shown by analysis of systems above 225 kV. A: single circuit line; double circuit lines: B1 = per route, B2 = per circuit

It showed that lightning was the greatest hazard for overhead lines and that insulators were the most vulnerable equipment, being responsible for 86% of the faults recorded.

The efficacy of earth wires was in proportion to their shielding angle and the analysis suggested that probability of a lightning strike was reduced by a factor as high as ten on a system equipped with earth wires as opposed to one without. In this connection a satisfactory basis for comparing lightning performance of varying types of construction and earth wire angle was shown to be the number of lightning faults per 100 km per storm day.

Single-circuit lines were less susceptible to lightning faults than double-circuit lines, for each circuit, presumably because of increased tower height. Auto-reclosure was shown to be very successful for non-persistent faults.

Experience on the Swedish system with auto-reclosure had been very good, said MR JANCKE, in commenting on the report. Earth wires were not used up to voltages of 270 kV and the fault incidence was about five times as high as those on lines with earth wires. A proposal to dispense with earth wires on 300 km lines met with opposition from the mechanical designers on the grounds that a stronger tower would be required to compensate for stresses otherwise taken by the earth wire and there would consequently be little saving in cost.

A rider was added to the report by MR WIRTHMANN (Belgium) who commented that in tropical climates the number of discharges between clouds compared with the number to earth was higher during a storm than in temperate climates, and this should be taken into account by modifying the criteria proposed in the report.

Corona Losses and Radio Interference

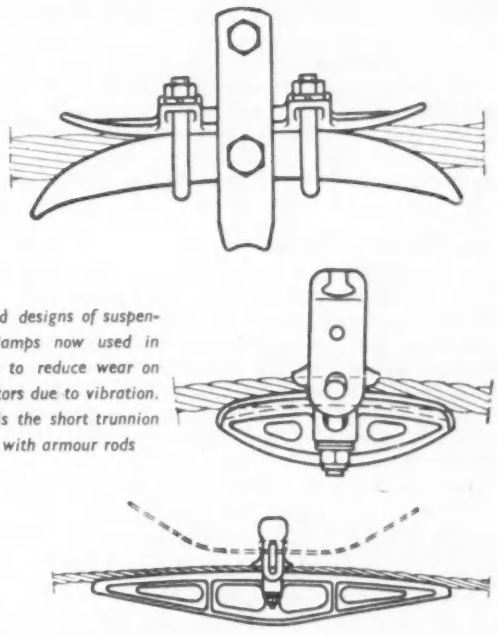
Several reports were devoted to this increasingly important aspect of the e.h.v. line. Considerable progress had been made in recent years and it was now possible to predetermine radio interference characteristics of new lines with accuracy. Much remains to be done, however, and particularly in America large research programmes were being undertaken. Construction work would soon begin on a line to be energised in 1960 at 750 kV. This will be used to investigate corona and radio losses and to try different conductor configurations.

Another e.h.v. project in the US would use data acquisition equipment to analyse and record a whole series of data including corona losses and the effects of lightning and surges. Initially, this line would be energised at 460 kV, but would include provision for later increase up to 750 kV. In Canada the Coldwater project was in operation for carrying out tests up to 500 kV and from these three projects and other investigations in Russia, Japan and France a much closer understanding of the problems of e.h.v. lines could be anticipated.

Overhead Lines

THIS year, the CIGRE overhead lines group opened the session by discussing limiting values for everyday conductor stress, that is, the stress which may be expected over the greater part of the life of a conductor. The closely associated questions of safety factors and the relative merits of single or bundled conductors also came in for comment and several papers dealt with aspects of wind and ice loading on single and grouped conductors.

Recommended values for everyday stress were given in a report of the study committee, based on several years' work. The committee related the e.d.s. to vibrations, and although this was supported by Swedish experts, it was not accepted by MR MAGGI (Italy) who considered



Modified designs of suspension clamps now used in Sweden to reduce wear on conductors due to vibration. Above is the short trunnion type with armour rods

their results too pessimistic. He felt that not enough was yet known about vibration problems and suggested that a testing station, erected in a high vibration area, would provide invaluable data, enabling tests to be carried out under uniform conditions and with uniform test equipment. He also thought e.d.s. values as recommended by the committee would be better confined to lines not exposed to vibrations.

The importance of selecting the e.d.s. to avoid vibration damage was underlined my MR SIMPSON (GB), and MR WHITE (Australia) recommended reducing the e.d.s. to 20% on 22 kV lines of armoured steel and aluminium. They also had, in Australia, some evidence of vibration trouble on new 330 kV lines with bundled conductors.

MR NICHOLLS (GB) made the point that care was necessary in taking protective measures that they did not themselves result in more damage to a line. He suggested that preformed armour rods should be used to avoid movement in the conductor-supporting assembly, so reducing wear.

A vibration measuring device which could be used with hot conductors or earth wires was described by MR WOLF (Germany).

Factors of Safety

Introduced for the first time at this year's conference was a preliminary note on a method for designing lines on their mechanical characteristics. The analysis interpreted the probability of certain forces acting on a line in such a way that the breakdown of conductors or of their supports could be predicted.

The fault probability was determined according to cumulative frequency curves of loading due to wind and ice, and their simultaneous effect. It was apparent that there existed a close relationship, often ignored, between design assumptions and factors of safety. Thus, a line designed for a given factor of safety and for loading conditions which may occur several times in a year, has a fault probability much higher than a similar line with the same factor of safety for loading conditions which would occur at much longer intervals, so that widely different factors of safety were actually obtained. The concept

required acceptance of probability principles applied to the mechanical safety of a line and the preparation of wind- and ice-loading curves and other guiding data.

MR SIMPSON (GB) emphasised the need to establish optimum load in conductors and on transverse supports. He said that there was a marked difference in the design of lines for ice-loaded as opposed to ice-free conditions and this had to be taken into account. It should also be remembered that foundations were a common cause of failure.

Bundled Conductors

Increasing use of bundled conductors has given rise to many theoretical and practical problems. One of these, the calculation of forces resulting from a broken conductor has been investigated and the results suggest that dynamic stresses in the sound conductor of a twin-conductor group may exceed three times the stress before breakage of the other conductor. This conclusion was based on model tests and there was some divergence of opinion as to the validity of such tests.

Tests to determine comparative wind loads and angles of deviation were described by MR MORS (Germany). Results implied that, for a quadruple bundle, they were relatively smaller than for a single conductor or twin bundles. That this was also true for ice-loading was confirmed by MR YODA (Japan).

Limited information was available on loading and in fact some reports were contradictory on the effects of ice-loading on single or twin conductors. But in the reports there was general agreement that no screening effect against wind pressure was obtained for conductors arranged horizontally. MR WHITE (Canada) said a good clamping action was imperative to ensure that conductors did not twist. In Canada, spring spacers, which allowed relative movement between conductors, were used on some lines.

The relative merits of large diameter single, as opposed to bundled, conductors for e.h.v. lines was influenced by a variety of factors, including erection problems, transport difficulties and of course economics. Single conductors about 2½ in. diameter were described by MR ABETTI (USA) which will be used on the 460 kV experimental line referred to previously. In selecting a single conductor, design factors were closely examined by digital computer techniques and the levels of corona and radio noise to be expected were assessed. However, it seemed at present this was about the limit in diameter for a single conductor and on a further 750 kV experimental line, four conductors will probably be used.

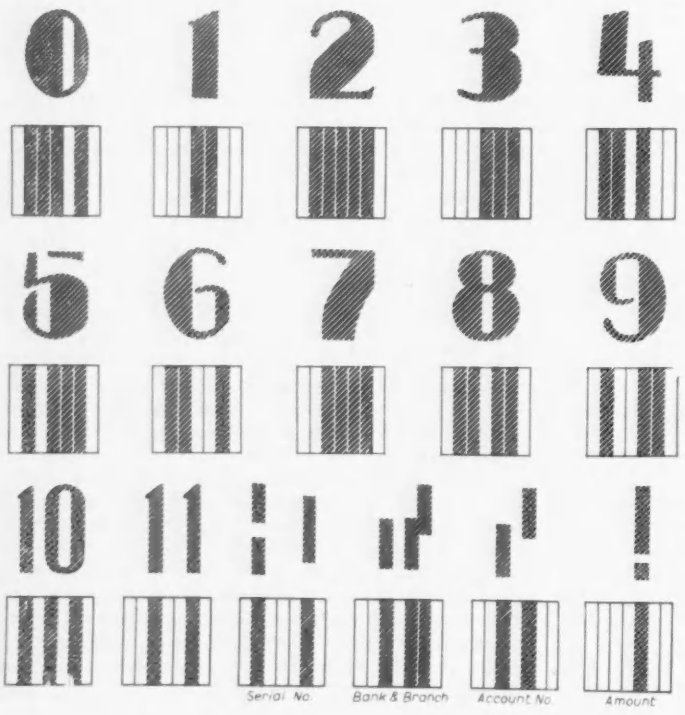
A 380 kV line now under construction was referred to by MR PARIS (Italy) which would have an expansible conductor about 2 in. diameter.

Interest in detection of faulty joints on hot lines led to the development of an infra-red detector in Germany, and MR FEINTUCH (France) referred to the use of thermometers on hot lines for detecting damaged sleeves.

Electronic reading facilitates cheque sorting

FRED—the initials stand for Figure Reading Electronic Device—is one of the latest attempts to solve the problem of sorting the increasing number of cheques which pass daily through the central clearing house for re-distribution to about 10.000 branches. The figure is conservatively put at 2.000.000 a day.

In the device proposed, cheques, in sizes ranging from 6 in. by 3 in. to 8 in. by 4 in., are numerically coded along the bottom edge in numerals based on the Broadway typeface to indicate the serial number, branch number, customers' identity and the amount. Passed through the electronic sorting machine, this enables the cheques to be sorted out at high speed ready for dispatch to their paying branches.



The secret lies in the manner in which the numerals are "read" by the detector or "bar code reader." This converts the figure into a five figure binary code according to the amount of "black" present as the cheque traverses the reading head in a vertical direction. This is shown clearly in the accompanying list of figures and their equivalent bar codes. The code for the figure zero is, for example, 11101 while that for the figure 3 is 00111, the predominantly black axes counting as one and the white, zero.

In the sorting machine the numerals are detected by electromagnetic means from figures printed with magnetic inks, the customer number and amount having been printed on the bottom of the cheque by a standard type of imprinting machine before dispatch to the clearing house. FRED, by this method, overcomes the difficulty of discrimination between different forms of handwritten numerals.

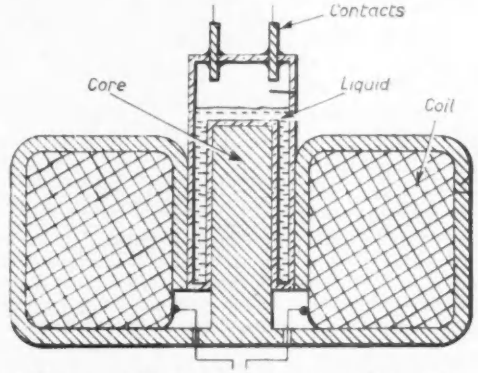
The device, developed by EMI Electronics, has been incorporated into a Pitney-Bowes/National high-speed document sorter recently demonstrated to representatives of British, Australian and European banks and the London Clearing Banks' electronic sub-committee.

PROGRESS IN PATENTS

SELECTED SPECIFICATIONS

Liquid Contact Relay

The use of conducting liquids, and in particular the liquid metal, mercury, as the bridging element between relay or switch contacts is not exactly new but hitherto the displacement of the liquid has been by tilting the container, raising the liquid level in the container by immersing to a greater depth a floating armature or non-metallic body, the expansion of the liquid in the container



Eddy currents induced in the liquid operate this a.c. relay

by heat or by increasing the volume of liquid within the container by transfer from an external plunger- or bellows-operated source. Now, in patent specification 839,293, by Minneapolis-Honeybell Regulator Co. of America, one more method is added to the list, this time employing eddy currents generated in the liquid to effect the displacement within a magnetic field.

In the device the liquid is enclosed within a sealed non-magnetic container—glass is quite suitable—having a cylindrical outer shape with an annular lower section and an upper section within which are the electrical contacts. This container is supported within a toroidal coil encased within a magnetic housing, the centre pole of which projects upward within the annular section of the container, the latter being so located as to be substantially within the upper half of the magnet system. Passage of an a.c. current around the toroidal winding induces circulating currents within the annular liquid path which, in turn, react with the flux in the magnet system to force the liquid upwards in the container where it bridges the contacts. The container can be hermetically sealed, an obvious advantage, and there are no linkages or sliding parts to jam.

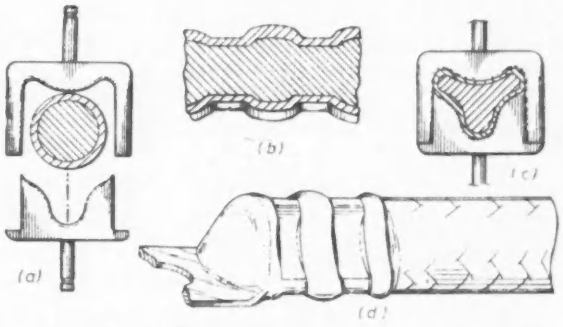
Fault Diversion in Breakers

Many patents have been taken out for methods of diverting fault current from the fault path to a current-limiting circuit during circuit-breaker operation with the object of absorbing the energy and preventing the excessive rise of the restriking voltage. Patent specification 839,369, accredited to A. Reyrolle and Co., of Hebburn, is another in which the centre point of a double-break switch element (i.e., the moving contact) is coupled to a limiting resistance or reactance through a diverter gap which breaks down should the restriking voltage exceed the critical value for the gap in series with one of the breaks. On restoration of the voltage to its normal value, the now restricted current is broken safely by the second break and the diverter gap is restored to its normal open-circuit condition. In one embodiment, for an unearthed three-phase system, two limiting resistances and gaps are connected across the three phases; others, for single-phase systems, embody a single resistance and gap.

Crimped Terminations

A point which was made in a contributed article on crimped terminations in these pages last year was the necessity for preserving some control over the lateral extrusion of the conductor during the crimping operation. In specification 839,090, attributed to Amp Incorporated of USA, attention has been given to this aspect and the form of crimp is a relatively new one in that it is basically triangular as compared with the more usual oval, hexagon and indent forms.

As the drawing shows, the use of this form gives a greater proportional reduction in cross sectional area without excessive spread of the finished termination, an important factor for terminations that may have to enter



Crimped termination incorporating lateral control of extrusion

a shrouded terminal block. The impression of two axially spaced bands in the crimp area, which is made within the radial confines of the die jaws, effectively limits the outward lateral extrusion while, at the same time, it produces a degree of inward opposing extrusion movements of the conductor between the bands to form a virtually solid "bead" of conductor metal. Figures given in the specification show an increase of tensile strength by this double-banded crimp of 35%-41% over that of a single-banded crimp of similar form with only an increase of 6% in the force necessary to make the crimp. No figures are given of performance under thermal cycling, but there is good reason to believe that this, too, should be exceptional.

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OVERSEAS NEWS

from our correspondents abroad

CANADA

ECA Fined

The Electrical Contractors' Association of Ontario was last month fined $7,500 for conspiring to run a combine, and an order was made prohibiting the association or its officials from doing anything directed toward a continuation or repetition of the offence. The Crown sought the restraining order under the Combined Investigation Act, following the association's conviction. It was held that the association had conspired to lessen competition in the sale of electrical equipment and material in Ontario, and had tried to limit the supply of labour to its members.

JAMAICA

CDC Loans

The Colonial Development Corporation has approved loans amounting to up to £3 million to the Jamaica Public Service Co. As we have already reported, this undertaking has in hand programmes for the expansion of generating plant and distribution facilities, as well as a frequency conversion scheme. For the power supply section, the CDC are to provide £1 million, and for the frequency conversion work a further £2 million to which the Royal Bank of Canada will add £500,000 for that purpose. The Colonial Development Corporation has also obtained an option to subscribe for 25,000 units at Canadian $30 a unit for stock of the company's Canadian parent concern, the Jamaica Public Service, such option to be exercised between January, 1963, and the end of 1964.

BRITISH GUIANA

Takeover Bid

The question of the future of the Canadian-owned Demerrara Electric Co. in British Guiana has been under consideration for a long time now and with the need for urgent action to maintain the supply undertaking seems to be steadily increasing. Additional generating plant was required some time ago, but the Government's indecision either to take over the undertaking or to provide the company with a revised franchise on which it could operate with confidence, has brought a stagnating situation, it seems. Even the company's general manager, Mr C. McIntyre, has said that the plant is in a critical state and whoever were the owners, it will take at least three years to rehabilitate the plant to meet the consumers' needs. The latest move is a takeover bid for the Demerrara Co.'s holdings in British Guiana, but Dr Cheddi Jagan refuses to permit this.

PERU

Finance for Schemes

For the expansion of electric power supplies in the Lima area, capital of Peru, the World Bank has approved a $24 million loan. The loan will help to finance two separate but related projects: the Marcapomacocha scheme to divert waters from lakes and rivers on the eastern slope of the Andes to the Santa Eulalia river basin in the west to provide more water for hydro-electric power development; and the construction of a power plant at Huinco, on the Santa Eulalia, to have an initial capacity of 120 MW. The new power facilities will increase by 70% the power now available in Lima, the administrative, commercial and industrial centre of Peru. The loan was made to the Lima Light and Power Company (Empresas Electricas Asociadas), a privately owned corporation and sole distributor of power in the Lima area.

HONDURAS

H.E. Loan

The World Bank has approved a loan of $8,800,000 for electric power development in Honduras. This will help to finance construction of a 27 MW hydro-electric plant together with the associated transmission lines. When the project is completed, Honduras for the first time will have a centralised power system capable of being expanded economically to meet future needs. The National Bank of Washington and the Grace National Bank of New York are participating in the loan without the World Bank's guarantee for a total amount of $103,000.

GREECE

Aluminium Scheme

Plans for aluminium production in Greece from local buaxite are now nearing completion. The Government has reached preliminary agreement with an international consortium for the establishment of the project, which is estimated to cost $75 million, towards which the Greek Government is expected to contribute a loan of $10 million. French and American interests are involved, together with the Greek ship owner, Mr Stavros Niarchos. An essential part of the plan is the provision of low-cost electricity supplies. These are expected to come from the hydro-electric plant to be built on the River Acheloos in west central Greece. The US Development Loan Fund recently granted a loan towards the cost of the latter project.

NIGERIA

More Good Results

Operations of the Electricity Corporation of Nigeria for the 12 months ended 31 March last were again favourable, continuing the better trend of the past few years, Dr Eni Njoku, the chairman, has revealed in Lagos. Net surplus for the period is £439,177, which compares with £427,177 for the previous year. With an increasing annual surplus, the Corporation could now finance a large portion of its development programme from revenue. The improved trading figures were the result of economies effected in operating costs, and streamlining staff. In addition, some £300,000 a year had been saved by the changeover from coal to oil fuel at the main Lagos power station. The proposals for hydro-electric schemes on the Nigeria and Kaduna Rivers and the use of natural gas were factors likely to influence the Corporation's future plans, he added.

INDIA

Nuclear Site?

It seems likely that India's first nuclear power station will be erected near Nangloi, 13 miles from Delhi. Talks in this connection have already been held between members of the Electric Supply Committee of Delhi Corporation and officials of the Government of India. The committee has urged the establishment of the station in its area because of the need for additional power for industrial expansion. The Delhi Electric Supply Committee has also decided to set up two new major thermal plants in Delhi with a capacity of 60,000 kW each under the third Five Year Plan. The two plants, expected to cost nearly Rs12 crores, are to be installed a mile downstream of the

existing power station at Rajghat. These will be in addition to the 30,000 kW thermal plant now being installed at a cost of nearly Rs4 crores. The proposal, it is understood, has already been approved by the Government of India and the Planning Commission. Delhi received 20,000 kW from the Bhakra-Nangal project last year. It is expecting a further 10,000 kW from Bhakra in November and 30,000 kW next year. It is estimated that by the end of the third Five Year Plan the installed plant capacity of the Delhi Electric Supply Undertaking will be nearly 284,000 kW against its present 80,000 kW.

PAKISTAN

Protection for Wires

Following a recommendation of the Tariff Commission, the Government of Pakistan have granted a measure of protection to the electrical cables and wires industry. Under this, rebate of customs duty will be allowed to the manufacturers of hard-drawn bare copper wire having cross-sectional area of not more than 0·0125 sq in., in excess of 10% on imports of copper rods from countries other than UK. In the case of imports from the UK, full rebate will be allowed. In addition, the sales tax on bare h.d. copper wire of up to 0·0125 sq in. produced in the country will be abolished. There is at present only one firm locally making this class of conductor—Pakistan Cables Ltd.

AUSTRALIA

Power Investigations

Queensland State Electricity Commissioner, Mr N. Smith, has announced that investigations are proceeding connected with the possible construction of a large power house in Queensland, at an estimated cost of about £50 million. For the past 12 months experts had been examining the practicabilities and economic aspects of the project, he said. Such a power house would be closely allied with the industrial development planned for the Weipa bauxite field. The Callide coalfield has been suggested as one of the possible sites for a power-house of this type.

NEW ZEALAND

Power Bills

A Bill is to be put forward in the current session of the NZ Parliament to approve and provide for the agreement with Consolidated Zinc Proprietary Ltd. for hydro-electric power development of Lakes Manapouri and Te Anan and the Waiau and Mararoa Rivers. Reference to this effect was made in the speech from the throne by the Governor-General, Lord Cobham. He also referred to the work continuously in hand to expand electricity supplies and discover new sources of power. During the session legislation is also to be presented to amend the State Supply of Electrical Energy Act.

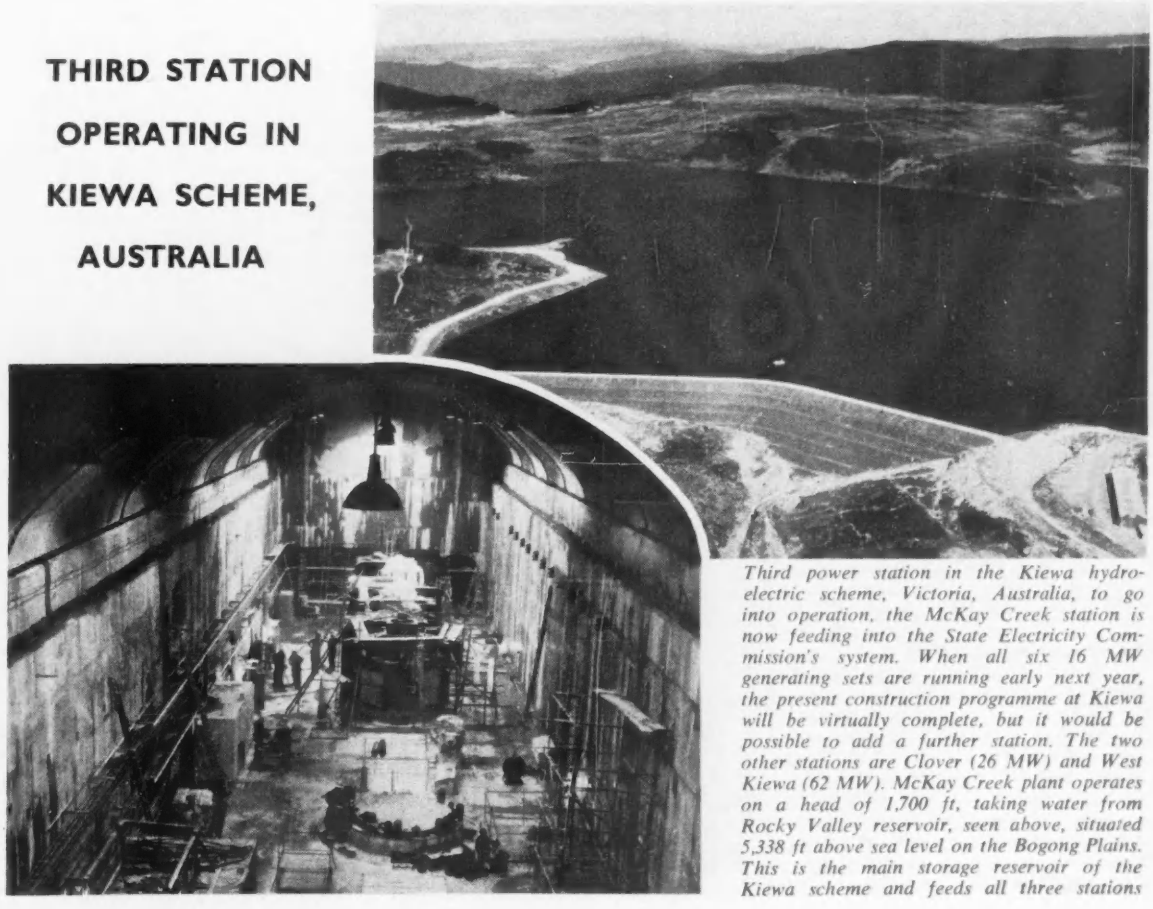
INDONESIA

Power Loan

An agreement was signed in Washington last month providing for the grant of a loan of $47½ million to Indonesia by the Export-Import Bank. Of this sum, $14,300,000 will be spent on the construction of an electric power plant in Surabaja. The loan is repayable over 15 years.

The Siemens Company, of West Germany, will shortly construct an electric power plant at Tandjung Priok, Indonesia, with a capacity of 25,000 kW. It will provide additional electricity for the Djakarta area as well as an adequate power supply for the Asian Games to be held in the capital in 1962. The company has entered into a number of credit contracts with the Indonesian Government totalling DM 50 million.

THIRD STATION OPERATING IN KIEWA SCHEME, AUSTRALIA



Third power station in the Kiewa hydro-electric scheme, Victoria, Australia, to go into operation, the McKay Creek station is now feeding into the State Electricity Commission's system. When all six 16 MW generating sets are running early next year, the present construction programme at Kiewa will be virtually complete, but it would be possible to add a further station. The two other stations are Clover (26 MW) and West Kiewa (62 MW). McKay Creek plant operates on a head of 1,700 ft, taking water from Rocky Valley reservoir, seen above, situated 5,338 ft above sea level on the Bogong Plains. This is the main storage reservoir of the Kiewa scheme and feeds all three stations

Personalities *in the industry*

Mr Robert W. Wait, A.M.I.E.E., has been appointed a director and general manager of M. and C. Switchgear Ltd. Mr Wait served his apprenticeship at the Sheffield works of Mavor and Coulson and while graduating through the various departments of the company, held successive appointments as electrical service engineer, technical representative and chief electrical engineer and designer. He is also a member of the Association of Mining, Electrical and Mechanical Engineers and was president of the West of Scotland branch of the association for the 1959-60 session.

Mr R. A. Joseph, B.SC., M.I.E.E., managing director of the Midland Electric Installation Co., Nottingham, is a member of the Working Party set up last week by the Minister of Labour to review the facilities provided in the workshops for the blind and to recommend any necessary changes.

Mr D. H. Rees has been appointed district manager, AEI-Hotpoint Ltd., Nottingham, in succession to **Mr W. A. Hastings** who has left the company to set up his own business. Mr Rees joined Hotpoint in April, 1956, as a sales representative in Cardiff following service as a sales engineer with GEC. He became Southern Division assistant in April, 1959, and was promoted to sales supervisor, London district, in January, 1960.

Dr N. A. de Bruyne, M.A., PH.D., F.INST.P., is resigning from the position of managing director of CIBA (ARL) Ltd. at the end of 1960. He will, however, remain on the board. On and after 1 Jan., 1961, **Mr R. F. G. Lea,** O.B.E., M.A., will become deputy chairman of the company. Mr Lea and Mr D. A. Hubbard will also become joint managing directors.

Membership of the Nuclear Safety Advisory Committee just set up by the Minister of Power and the Secretary of State for Scotland (to which we refer on page 31), includes many personalities well known in the electrical industry. The chairman is **Sir Alexander Fleck,** K.B.E., F.R.S., and among the 23 other members are **Dr T. E. Allibone,** C.B.E., F.R.S., D.SC., PH.D., M.I.E.E., F.INST.P., director of AEI Research Laboratory, Aldermaston; **Sir John Cockcroft,** O.M., K.C.B., C.B.E., F.R.S., M.A., PH.D., M.SC.(TECH.); **Mr P. T. Fletcher,** C.B.E., B.SC., M.I.C.E., M.I.MECH.E., M.I.E.E., deputy managing director, Atomic Energy Authority, Development and Engineering Group, Risley; **Sir Willis Jackson,** F.R.S., D.SC., D.PHIL., M.I.E.E., M.I.MECH.E., F.INST.P., director of research and education, AEI (Manchester) Ltd.; **Major-General S. W. Joslin,** C.B., C.B.E., M.A., M.I.MECH.E., M.I.E.E., HM Chief Inspector of Nuclear Installations; **Prof J. M. Kay,** M.A., PH.D., M.I.MECH.E., A.M.I.CHEM.E., Professor of Nuclear Power, Imperial College of Science and Technology, University of London; **Mr T. W. McCullough,** O.B.E., HM Chief Inspector of Factories; **Col G. W. Raby,** C.B.E., M.I.MECH.E., M.BRIT.I.R.E., managing director of Atomic Power Constructions Ltd.; **Mr L. Rotherham,** M.SC., F.INST.MET., member for research, Central Electricity Generating Board, and **Dr F. A. Vick,** O.B.E., F.INST.P., deputy director, AERE, Harwell.

Mr G. Archer has been appointed president of Mond Nickel Co. and Henry Wiggin and Co., its subsidiary. He has relinquished his position as chairman of both companies. **Mr Ivon A. Bailey** has been appointed chairman and chief officer of both companies. **Dr L. B. Pfeil** has been appointed vice-chairman of Mond Nickel and **Mr J. O. Hitchcock** has been appointed managing director of Mond Nickel and deputy chairman of Henry Wiggin. **Mr H. W. G. Hignett** has been appointed managing director of Henry Wiggin.

Mr John Keir, personal assistant to the managing director of the Marconi International Marine Communication Co. Ltd., retired from the company's service at the end of last month. His retirement marks the end of a long and distinguished career which began when he joined the Marconi Marine Company in 1915.

AEI Electronic Apparatus Division announce the appointment of **Dr J. M. Westhead** as manager, Valve and Semiconductor Sales Department, Lincoln, to succeed **Mr F. Baxendale** who will remain as consultant. Dr Westhead has been deputy manager of the department since 1 April this year. After attending Cheadlehulme School, Cheshire, Dr Westhead studied at Oxford University where, in 1950, he obtained his B.A. degree, with first-class honours, in Physics. Two years later he gained his doctorate (nuclear physics), at this time holding the position of University demonstrator in electronics. After leaving Oxford Dr Westhead took a management training course with Coates Bros. printing ink and synthetic resin manufacturers. In February, 1956, he joined BTH Electronics Sales Department (now AEI Electronic Apparatus Division) and was appointed assistant manager, Valve and Semiconductor Sales Department, Lincoln, in October, 1958.

Mr T. G. Sandy, M.B.E., has been appointed a director of George E. Taylor and Co. (London) Ltd. and George E. Taylor (Overseas) Ltd., as from 1 July. Mr Sandy joined the company in 1935 and was previously the Middle East manager and senior representative in that area for the parent company, the Turiff Construction Corporation Ltd. In his new capacity, Mr Sandy will be responsible for all operations overseas for George E. Taylor in the electrical and mechanical field. It is also announced that **Mr S. G. Brown,** A.M.I.E.E., has been appointed contracts manager of the Electrical Division of George E. Taylor and Co. (London) Ltd. Joining the company in 1936 as an apprentice, he was, prior to his new appointment, chief engineer of that Division.

Mr J. F. E. d'A. Willis has been appointed to the executive office of chairman of Hall-Thermotank in the place of **Mr Iain M. Stewart** who has resigned for domestic reasons. Mr Stewart remains a director of the company and chairman of Thermotank, its subsidiary. It is understood that Mr Stewart is also resigning from appointments other than in the Hall-Thermotank group. These will be announced later. **Mr J. C. Akester** has resigned from the board of Hall-Thermotank, but retains the chairmanship of its subsidiaries, Vent-Axia Ltd. and Axia Fans Ltd.

Mr L. J. M. Knotts, ASSOCIATE I.E.E., M.I.R.S.E., signal engineer, Scotland, to British Railways, retired at the end of June. His successor is **Mr H. O. Baldwin,** A.M.I.R.S.E., who was previously assistant

Mr R. W. Wait

Mr D. H. Rees

Dr J. M. Westhead

signal engineer. Mr Knotts had held the position since January, 1955, and earlier was assistant (signals) at the Railway Executive headquarters, being engaged in policy and planning in connection with signal standardisation. Mr Baldwin joined the LM and SR in Glasgow in 1930. He became senior signal and telegraph inspector at Perth in 1944 and, two years later, returned to the Divisional Signal and Telegraph Engineer's office, Glasgow, as assistant (signals). In 1947 he took up the post of divisional assistant (signal and telegraph) and, in November, 1948, was appointed assistant signal and telecommunications engineer, Scotland, a post which was later redesignated assistant signal engineer.

R. W. Gregory and Partners, consulting engineers, announce that they have taken into partnership **Mr Geoffrey P. Cundall,** B.SC., A.M.I.E.E. Mr Cundall was educated at Bootham School, York, and Leeds University, and did his practical training with Metropolitan-Vickers Ltd., the BTH Co. Ltd. and BICC Ltd. Following a period with BICC as contracts engineer in London, he was appointed sales engineer at their Newcastle office. Mr Cundall was chairman of the North Eastern Students' Section of the IEE during the 1950-51 session and received a student's premium for his paper entitled "The Development of Power Cables." He has also contributed articles to the technical Press. He joined the staff of R. W. Gregory and Partners as a senior electrical engineer in January, 1955.

Mr Frank Rostron, M.I.E.E., director of Ferranti Ltd., has been appointed a director of the Vulcan Boiler and General Insurance Co.

Mr R. D. Hoskin, A.M.I.E.E., power services engineer to J. S. Fry and Sons Ltd., has been appointed a member of the Industrial Coal Consumers' Council.

The Royal Society announce that the Paul Instrument Fund Committee have awarded a grant of £1,000, in supplement of a previous grant, to **Prof J. D. McGee,** professor of instrument technology, Imperial College of Science and Technology, London, for the construction of a television system for X-ray image intensification. In addition, a supplementary grant of £500 has been made to **Dr H. Motz,** Donald Pollock reader in engineering science, University of Oxford, for the construction of a linear accelerator working at 1·6 cm (J-band). The Council of the Royal Society appointed **Dr D. T. Edmonds,** of the Clarendon Laboratory, University of Oxford, to a Mackinnon Research Studentship from 1 Oct., 1960, to enable him to carry out magnetic investigation below 1° K in large magnetic fields at the Clarendon Laboratory, Oxford.

Mr G. P. Cundall

Mr A. Stephens

Mr R. W. H. Vivian

Mr A. Stephens has rejoined Honeywell Controls Ltd. as senior flow engineer at the company's Greenford head office. Mr Stephen's extensive knowledge of flow and other instrumentation includes two years with Humphreys and Glasgow Ltd. on the Chesterfield underground gasification project, two years as instrumentation contracts engineer with Honeywell Controls Ltd., 15 months with George Kent Ltd., four years with Electroflo Meters Co. Ltd. and four years' apprenticeship with the Ministry of Supply. Honeywell Controls also announce that **Mr R. W. H. Vivian** has been appointed at the Greenford head office to specialise on application engineering using the company's electric miniature instrumentation, which is being introduced this year in the United Kingdom. Mr Vivian will shortly leave this country for a brief study of United States experience in this field.

Previously with Whipp and Bourne Ltd., **Mr S. D. G. Crowther** has joined B and R Relays Ltd. as their representative in the north of England. The latter concern have also appointed **Mr C. Brayson** as works manager—he has been their production controller for the past four years.

Mr J. J. Gracie, C.B.E., M.I.E.E., a director of the General Electric Co. Ltd. and general manager of its Witton engineering works, is to retire at the end of this year at his own request.

Previously London instrument manager of Sangamo Weston Ltd. **Mr J. P. Minister** has joined Measuring Instruments (Pullin) Ltd. as general sales manager.

We were in error last week in referring to **Mr J. D. Nicholson,** B.SC., M.I.E.E., of the Yorkshire Electricity Board, as being elected vice-chairman of the Yorkshire Council for Further Education. Mr Nicholson is a member of the governing body of that organisation and has been re-elected vice-chairman of the board of governors of the Bradford Institute of Advanced Technology. We offer our apologies.

Manager of the Lynton office of the South Western Electricity Board for the past ten years, **Mr A. R. Taylor** has this week taken up a similar position to the board at Langport, Somerset.

Earlier a deputy chief scientist with the UKAEA, **Dr P. Fortescue** has been appointed chief research and development engineer of the newly formed General Atomic Europe. He already holds a similar post with the General Atomic Division of General Dynamics Corporation in San Diego and will continue to act in that capacity. Later this year he will be in charge of a group working on the development of a high temperature gas-cooled power reactor in the 100 MW range suitable for Europe's power requirements.

Mr E. M. Price, general manager of the English Electric Co. Ltd., and Lord Nelson of Stafford, chairman of the company, view the portrait of Lord Nelson unveiled at the firm's Rugby works last week

OBITUARY

Mr W. E. Affleck, M.I.E.E., manager of the Guildford district of the South Eastern Electricity Board, died on 28 June. Mr Affleck was in his sixty-seventh year and had been due to retire at the end of June, as we reported on 23 June. He became chief engineer and general manager of the Guildford Corporation electricity undertaking in 1921, and continued with Seeboard as Guildford manager from 1948.

Mr W. Tancred, A.M.I.E.E., formerly of the Engineering Dept of the London Power Co. Ltd., died on 20 June.

B.R. modernisation progress

INCREASED emphasis on railway modernisation, as recommended in a White Paper published in July last year, is a notable feature of the British Transport Commission annual report and accounts published last week. Detailed and "popular" versions are available.

Although to the disgruntled rail passenger, delayed and inconvenienced by modernisation, progress may seem to be slow, the report shows that there is much going on behind the scenes. Problems of research and development associated with electrification are being tackled at Derby and it is proposed to build there a new research laboratory. Computing techniques are now being used at Crewe, Derby and Wolverton for stores control and wage calculations and at Derby a digital computer is solving problems of mechanical and structural design.

Linear programming of computers has been used for determining the distribution of empty colliery wagons. Considerable economies have been achieved in running empty trains by this technique.

New Traffic Committee

The Commission recently established a traffic committee for planning new and improved transport facilities and increasing operational efficiency. Operational research is expected to enable the commission to reduce the number of coaches and wagons in service, a trend which it is hoped will enable 15% more passengers to be conveyed with 17% less rolling stock. The number of freight vehicles was reduced during the year by about 6%.

In Scotland, a study is in progress on application of large-scale electronic data processing techniques for improving regional operation.

Electrical research has been largely concerned with the intended ultimate replacement of d.c. traction motors by a.c. It is expected that simpler maintenance and reduced cost will be possible if a system based on controlled-rectifiers, now being studied, proves successful.

In the field of electronics, the Commission have placed development contracts for electronic interlocking signalling to replace the traditional mechanical or relay frames.

Electrification Progress

Work is now proceeding on the second phase of the Kent Coast electrification scheme. Since the first stage was completed in June last year it has proved to be a great success, with passenger bookings more than 25% higher than before.

Wiring in the Crewe area, involving 80 track miles of overhead equipment, is now completed and good progress is reported on other sections of the London Midland electrification scheme.

Work is also going well on conversion of the Liverpool Street and Fenchurch Street to Southend and Chelmsford lines from 1,500 V d.c. to 25 kV a.c. The line from Liverpool Street to Bishop's Stortford should be completed during 1960.

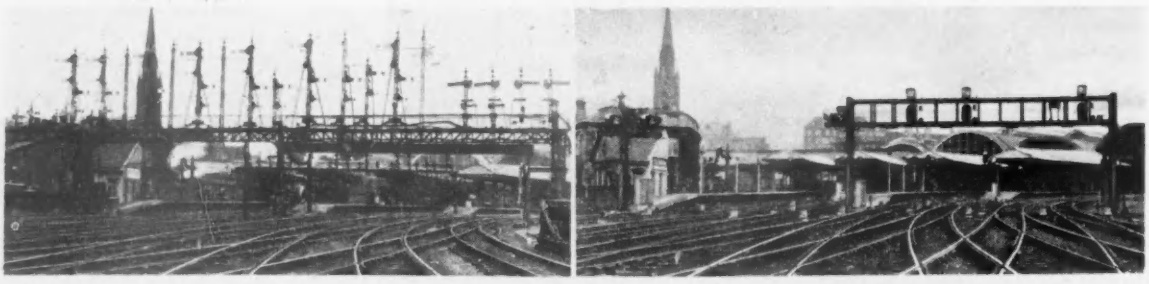
The Commission's policy is to press rapidly ahead with the suburban lines and London Midland electrification schemes, but they are also studying the eventual electrification of the East Coast main line and extension of the West Coast main line to Glasgow.

Signalling

Important work on standardisation of signalling techniques and equipment for all regions is being pursued. The Commission are investigating applications for simplified systems and miniaturised components.

Improved track and signalling have enabled speed restrictions to be eased on several main lines. Between Manchester and Crewe, three modern power signalling boxes have replaced 21 mechanical boxes. A notable feature of this installation is the use of electronic coding equipment, using transistors, for the remote control of satellite interlockings over one pair of wires.

The first installation of centralised traffic control was completed last year. This system enables trains to be controlled from a central point over very long stretches of track and is in use on the Sheerness branch. Another system has been developed for the York-Hull line, which will be operated from the power signal box at York. This scheme will have 19 out of its 23 level crossings controlled automatically by half barriers.



Spectacular improvement in appearance of the rail approach to Newcastle Central station with the completion in April last year of conversion from semaphore to colour light signalling. For the driver, the new system gives easier interpretation

Towards better efficiency

W.P.C. MADRID MEETING PAPERS REVIEWED

EFFICIENCY of power supply in all its aspects has always been a prime concern of the World Power Conference and the recent meeting in Madrid* received many papers relating to this theme, with particular reference to the problems of where there are mixed hydro and conventional thermal or nuclear stations feeding into a system.

Load Dispatching

A good example is the paper by five engineers of Canadian supply authorities (Deguise, Macfarlane, King, Lawson and Nevison) on techniques that have been evolved for securing maximum output from existing hydro facilities and for effecting maximum economy of dispatch from a mixed hydro-steam system. In connection with the general problem of increasing efficiency, they suggest there is an important place in the staff structure for a "system performance analyser," charged with the responsibility of checking hydraulic operations and general system dispatching to ensure that they are reaching the proper standards of efficiency. So far as existing installations are concerned, the comment is made that changing costs often make it advantageous to increase the output of sets installed many years ago. Techniques suggested include cutting back the inlet and trailing edges of buckets on Francis runners, and rewinding generators with coils of modern design, and so of higher current rating for the same size. It is also suggested that steps should be taken to minimise the reactive power required of generators by installation of synchronous condensers or capacitors at the load end of a transmission line.

On the question of dispatch, the authors report studies on a digital computer of the short-term aspect of dispatch from a system containing two or three steam plants and two to four hydro plants. These investigations have shown that savings of from £70 to £290 a day are obtainable by using co-ordination-equation loading schemes, which work on the basis that optimum load sharing exists when the incremental cost of power delivered from all generating stations to a hypothetical load centre is the same. The sort of finding thrown up by such investigations is that it is cheaper to use some steam power near the load when hydro plants begin to approach full loading, because incremental efficiency of the hydro plant falls badly at this point and transmission losses increase rapidly at higher line loadings. A difficulty of co-ordination-equation techniques is that they cannot be used to take into account operation of a pumped storage station. A different approach is being used for this.

Ontario Hydro have established an operations research team to extend studies in this field and it is expected that to implement the results of this work a combined digital-analogue computer will need to be installed. This may be connected to an automatic control system at present being put into operation to give automatic load-frequency control for four steam stations and five hydro.

Russian Load-frequency Control

Russian engineers V. M. Gornstein and A. G. Moscalyev also discuss minimum cost generation in a mixed hydro and thermal scheme. In particular, they consider the relative merits of completely central load-frequency control and of decentralised systems. In the former, the central control point is equipped with both an incremental rate data unit, which relates frequency to incremental cost, and a function generator relating plant load to incremental cost. In this system, the load to be taken by each plant is transmitted from the control centre over an individual telemetering channel.

In the decentralised system only the incremental cost data is transmitted to each plant, which has its own function generators installed to determine loading. This permits reduction of the number of telemetering channels and facilitates the task of keeping up to date the information in the function generators, allowing for changes in plant conditions.

A decentralised automatic control system has been developed in the USSR using a local incremental cost data unit. Telemetering channels to the control centre are necessary only if transmission losses are to be taken into account in determining loading.

A disadvantage of decentralised systems is that there is some loss of control of plant personnel by the load dispatcher.

The paper gives attention to the changes in cost calculations which have to be made to take account of draw down of reservoirs in hydro schemes and of variations in head caused by variation in tailwater level. The necessary calculations are tedious unless highly mechanised and in the USSR there is much attention to application of computer techniques to such work.

Integrating Nuclear Plant

Mr C. C. Whelchel, of the US Pacific Gas and Electric Co., discusses the position of base load nuclear plants in an integrated hydro and thermal power system. His system operates in the State of California, serving an area of 94,000 sq miles and a population of over six million. It has 77 generating stations and a peak load estimated to reach about 8,200 MW by 1965. There are plans for building a 60 MW nuclear unit of the boiling water type at Humboldt Bay in the north of the area, with a capital cost of £7·4 million and electricity generated cost of 0·68 d/kWh.

It is estimated that such a plant can give availability of 90% or higher and that the system can absorb 40% of its total capacity from sets operating at 90% plant capacity or better.

* This is the second article reviewing papers presented to this meeting. The first was published in the issue 16 June, p. 964.

District Heating

Another aspect of efficiency in operation is the use of back-pressure generation, especially in relation to district heating and the burning of very low-quality fuels. One important difficulty with any district heating scheme is that of measuring the quantity of heat used by each consumer. A paper by Dr J. Vlach (Czechoslovakia) describes a meter based on the principle of an attached thermal resistance. It incorporates a sensing element about 2 in. by 1 in. by ¼ in. in size which contains sufficient thermocouples in series to give a potential of about 13 mV for a temperature difference of 10°C between the sides of the element. The element is used in conjunction with what is described as an "electrolytic counter" to integrate the instantaneous heat output from the radiator to which it is attached. A trial series of meters worked well and accuracy is estimated as ±2% with several radiators in a flat, or ±5% with only one radiator.

In Sweden, despite the overwhelming predominance of hydro plant, there has been attention to back-pressure power generation, which is described in a paper by Messrs O. Berg, C. Elgerus and S. Lalander. Calculations have suggested that for domestic buildings (blocks of flats, etc.) back-pressure generation with district heating is more economical than the operation of heat pumps. Even with electricity at the costs appropriate to a hydro system, it seems that most cities of 50,000 or more inhabitants in South or Central Sweden are suitable for district heating schemes. In one typical plant there are three 290 klb/hr boilers burning p.f. coal or oil fuel. Each supplies a turbo-alternator, two of them pure back-pressure with the heat exchangers cooled by water at 70°C to 110°C depending on the load on the heating systems. Each turbine gives 25 MW output. The third unit is a pass-out machine exhausting to vacuum. Energy storage is provided in hot water accumulators with a capacity of 490 MWh. Operators of plants of this nature have agreement for power exchange with the national supply authority.

In connection with low grade fuels, Messrs V. Zeman and L. Tintner (Czechoslovakia) describe a pulverising plant and boiler which has been designed for dealing with a wood-like lignite. A relatively long form of cyclone furnace has been developed, which is claimed to be particularly suitable for fuels having high ash content and low reactivity. Unit ratings from 200 to 400 MW are thought to be in prospect, although a pilot plant being designed will have a steam rating of only 55 klb/hr. From France, Mr G. Bouttes discusses problems of burning high ash content coals at power stations in the north of France. The cost of burning brown coal in Polish power stations is dealt with by Mr W. Fiszer, who concludes that electricity may in general be produced at lower overall generated cost from such coal in Poland than from bituminous coals, although transmission costs may alter the delivered price comparison.

Load Forecasting

The electricity industry takes as granted the probability that demand will grow; it concentrates attention on the rate to be assumed for planning purposes. The question is discussed by Messrs H. J. Beard and A. W. Pedder (Merz and McLellan) with particular reference to smaller electrical systems. So far as large systems are concerned, there is a reasonable measure of agreement on method, with extrapolation on a simple exponential law basis for medium- and short-term forecasts and incorporation of a regressive factor to allow for falling off of rate of increase in the longer term. Such mathematical exercises based on statistics of the past should be checked by forecasts of industrial activity in the future.

For smaller systems, the authors conclude that no wholly satisfactory technique is available; the judgment of the forecaster is dominant. Close attention to the early prospects for each of several consumer groups, followed by aggregation, can help to get the figures for early years to better accuracy and this is usually particularly important.

Forecasting techniques used in the US are described by Messrs A. S. Griswold and F. D. Campbell, of the Detroit Edison Co. This company is one of several reporting to a central organisation and uses extensively statistical information on matters such as population growth, rate of movement to suburbs, house building and the plans of builders to install electrical appliances in the houses they sell. Attention is also given to the way consumer trends can be affected by promotional efforts.

National Plans

National plans for electricity supply are dealt with in some papers presented to the meeting. India is amongst them, Messrs M. Hayath and S. Swayambu, of the Government of India, dealing with preliminary studies being made for that country's third Five Year Plan, as well as progress with its predecessors. The plan is due to come into effect in April, 1961, and early indications are that it will have to provide for a doubling of installed capacity from 6,400 MW to 12,800 MW. After 1966, it is provisionally estimated that an eight-year doubling period will apply in India, giving an installed capacity of 60,000 MW by 1985.

To implement plans along these lines, several large hydro stations are being built, including the 1,050 MW Bhakra-Nangal project. Thermal stations with machines of up to 60 MW rating are already in service and machines of 75 and 125 MW capacity are under installation in the Damodar Valley Corporation scheme. Plans are being made for installation of a 250 MW nuclear power project on the west coast of India. There are extensive transmission schemes and the first 230 kV lines should come into operation within the next few years. So far, however, there are hardly any lines across State boundaries (most electricity boards are organised on a State basis). A number of regional grid systems are foreseen, with an all-India grid as a distant prospect.

Egypt, which at present has an installed capacity of 764 MW in a mixed economy organisation, reckons that the immediate rate of increase of demand is about 11% (six-and-a-half-year doubling period) falling to 7% (ten-year doubling period) by 1979. The Aswan Dam and High Dam schemes on the Nile, of course, play a major part in ideas for meeting this growth in demand. For the latter, eight 135 MW Francis turbine machines are envisaged as a first stage, with eight 174 MW machines in the second stage.

The paper in which these figures are put forward by Prof M. A. B. El Koshairy and M. K. Nabih also discusses the interesting possibility of bringing water from the Mediterranean and allowing it to fall into the Qattara Depression and there evaporate. Thirty-seven mile long tunnels would be necessary and the capital cost might be £250 million for 420 MW installed capacity. An alternative scheme, using shorter tunnels or even an open canal all the way, might cost £180 million with 600 MW installed capacity but only 300 MW available power. However, the Qattara scheme is unlikely to come into operation until 1980 at the earliest.

Alternator rotor angle indication

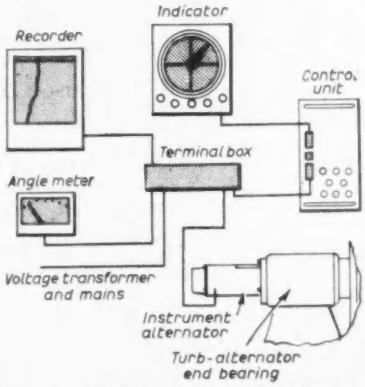
IN recent years, turbo-alternators have been required, increasingly, to supply leading MVAr. At one time alternators were designed with a relatively high short-circuit ratio, enabling leading reactive MVA to be supplied while the machine was operating close to the steady state stability limit of 90°.

More recently, work has shown that it is practicable to operate machines in the region of dynamic stability with a relatively low short-circuit ratio, yet still supplying leading MVAr.

Operation in the dynamic stability region implies that the angle between the rotor pole axis and the alternator terminal voltage exceeds 90° and, in fact, discussions at this year's CIGRE indicate satisfactory stable operation with rotor angles up to 130°.

To make use of this increased margin of generating capacity, indication of the rotor load angle for control purposes is required, and it was for this purpose that Ross Instruments Ltd. designed their rotor angle indicator.

The indicating equipment comprises a three-phase generator driven from the main alternator shaft and supplying one winding of a precision differential receiver. The other winding of the receiver is energised from the main alternator busbars through a v.t. The shaft of the instrument takes up an angular position corresponding to the difference between these two supplies and its position is transmitted to an indicating instrument calibrated in angular displacement. A phase shifting control enables the instrument to be simply calibrated so that, with the alternator on no-load, the rotor angle indication can be set to zero.



Schematic of alternator rotor angle indicating equipment with recorder and separate indicating instrument

The three-phase instrument alternator is a permanent magnet machine generating at 50 V. It is coupled to the main alternator shaft through a centring plate which can be easily fitted and a specially designed universal coupling which allows for angular and lateral misalignment and will also accommodate axial movement of the alternator shaft without damage.

Rotor load angle is indicated on a 6 in. panel mounting meter. Visual and audible warning that the rotor angle is approaching a predetermined limit value may be obtained by setting the pointer on the meter to any angle between −30° and 180°.

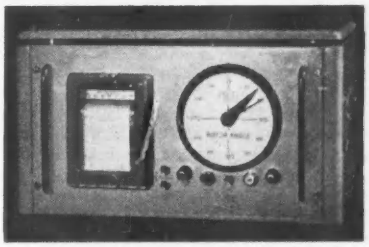
The control unit also includes relays to connect the differential receiver simultaneously to the instrument alternator and to the main alternator busbars.

If a fault should occur on the voltage transformer, or if the voltage should fall below a value necessary to ensure accurate indication, a phase failure relay operates to disconnect the instrument.

In addition to the control panel meter, a separate panel mounting indicator with 4½ in. scale can be supplied and also a specially damped chart recorder. These units may be mounted in a convenient position in the turbine hall or control room.

The instrument has been developed in conjunction with the CEGB and units will shortly be operating at Acton La, Cliff Quay and Littlebrook stations.

A further advantage of the instrument in a power station with several alternators installed is that the indicators show immediately if one machine falls out of step, or if pole slipping is taking place. Remedial action can then be promptly taken by the operating staff.



Portable or rack mounting version of the Ross Instruments rotor angle indicator with chart recorder. The instrument gives direct indication of alternator rotor angle

Electronic static switching

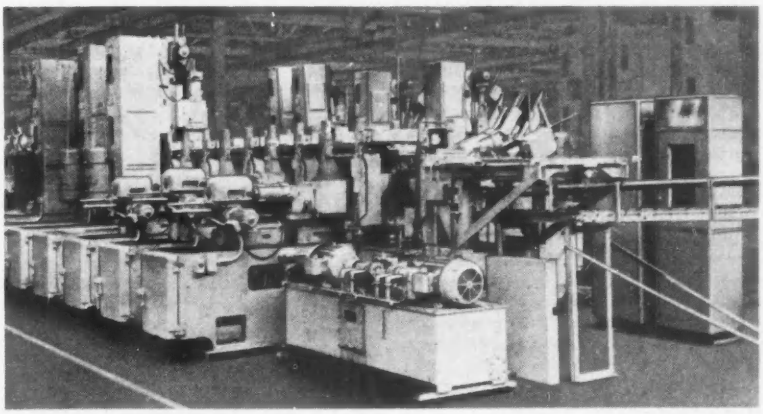
TO reduce maintenance troubles and breakdowns on complex transfer lines used in the motor industry, the Austin Motor Co., in conjunction with Hivac, developed an electronic switching scheme using cold cathode tubes.

The ACCESS system, Austin Cold Cathode Electronic Switching System, is claimed to carry out interlocking and relay functions by cold cathode tubes more reliably and quickly than an equivalent relay system, while retaining electro-mechanical contactors for the main power switching functions. The system is now being manufactured under licence by Donovan Electrical Co. Ltd.

The cold cathode tubes and their associated components are mounted on printed circuit cards which can be plugged into the control gear panel. This arrangement gives a compact construction, which can be easily maintained and which can be housed in pressurised cubicles to exclude dust.

The glow of the tubes enables the control sequence to be quickly checked and their power consumption is considerably less than for a corresponding relay installation.

A feature claimed for the system is that a single return wire can be used for two limit switches and their current rating is 5 mA peak, thereby permitting a considerable reduction in the size and cost of cabling.



Cold cathode ACCESS electronic switching equipment for this transfer machine is housed in the two rear cubicles. Compact construction with high reliability and ease of access are claimed for the system

Machine Tool Exhibition, 1960

ELECTRONIC CO-ORDINATE CONTROL ADVANCES

ONE of the most significant aspects of the International Machine Tool Exhibition at Olympia this year is the manner in which the electronic control of machine tools from co-ordinate settings has progressed. Until comparatively recently this technique, in which dimensions taken from a drawing are transferred to the machine tool controls electronically as two- and three-dimensional co-ordinates, have been largely adaptations of standard machine tools with the necessary attachments for receiving the taped signals and converting them to adjustments of the feeds and slides. At this year's exhibition many of the machine tools have been specifically designed from the drawing board upwards for this form of control alone.

The exhibition, which was opened on 24 June by the Rt Hon Reginald Maudling, M.P., President of the Board of Trade, and will continue until 8 July, has gathered together under one roof what is probably the most comprehensive range of British, American and continental machine tools in the world. At the opening luncheon, the president of the Machine Tool Trades' Association, Mr E. W. Field, O.B.E., mentioned that there was over 8,000 tons of machine tools on the floor with an installed electrical load of 18·5 MVA and, despite the 179,000 sq ft of space which had been provided on the ground floor, this was only about 68% of the area which had been asked for by exhibitors and would-be exhibitors.

Co-ordinate control equipment

Many firms have taken an active interest in the application of co-ordinate control systems and it has now been generally realised that the high precision of measurement possible with the application of co-ordinates from two or three datums is valueless unless the machine tools themselves are designed with the corresponding accuracy of response, which means reduction of backlash in traversing mechanism without, however, increase in frictional forces and, of course, wear must be correspondingly reduced. One of the first things which may be observed in the exhibition is the wide use of protective bellows over slideways to protect them from swarf and dirt, something which was almost unknown a few years ago.

Some companies, like the Staveley Coal and Iron Co., have set up research teams and laboratories with the sole object of studying this aspect of tool design and application. The practical results of their early endeavours are to be seen in the "Autonomic," a multi-purpose drilling-boring-milling machine, which is entirely controlled from the perforated tape control unit, the machine tool being a product of James Archdale and Co., a subsidiary.

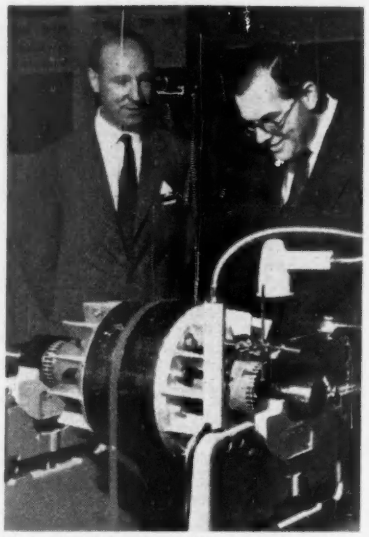
AEI have also taken an active part in this field but are using magnetic tapes in place of perforated tapes. This necessitates a special machine for imprinting the codes on the tape which has been set up at the AEI Tape Service Centre, Leicester. This system, known as the "Helixyn" control, can be seen in operation on a vertical milling machine on Messrs Kendall and Gent's stand.

Ferranti is another famous electrical company which has been concentrating on taped control systems and, moreover, has been applying moiré fringe techniques to measurement and inspection of work produced on machine tools both during machining and after completion. The inspection equipment is to be seen on the Ferranti stand.

Examples of the Ferranti control are to be seen on the E. H. Jones stand where a Kearney and Trecker 415T milling machine is tape controlled on three axes. On the High Precision Equipment stand there is also a two-dimensional profiling machine which has been specially built to incorporate Ferranti tape-control for the production of precision cams and templates.

An EMI-Grimstone drilling machine with a seven-position turret head and EMI tape control is demonstrating an automatic cycle of drilling, reaming and tapping 130 holes in a mild-steel plate. Priced at £2,000, this shows that precision tape-controlled equipment need not be excessively expensive. Vero Precision Engineering are showing a similar tape-controlled automatic drilling machine of Catmur manufacture and this company has demonstrated that, on specimen production jobs, the saving in machining time and the increase in productivity by this form of control can total up to the initial cost of the machine in little more than 12 months. Other tape-controlled machines are to be seen on the Herbert stand, where the "Datatrol" system is applied to a Herbert-deVlieg jigmill.

A variant of tape control, the Nickols Automatic Sequence control, is also being shown on the Nickols stand. This is a compact plug-in unit which, with its related electro-pneumatic, electro-hydraulic or all-electric servos on the machine tool, enable any machining operation to be rapidly set-up for automatic working by the simple process of plugging-in a number of "jumpers" on the unit panel.



Mr Reginald Maudling, M.P., President of the BoT, with Mr R. W. Addie, Marketing Director, EMI, examining an electronic dynamic balancing machine on the EMI stand

Moiré fringe techniques

Moiré fringe techniques as applied to machine tool processes, referred to above, are adequately explained on the DSIR and NPL stands. The latter, who are mainly responsible for the development of these techniques in association with the National Engineering Laboratory, have published a concise ten-page booklet, "Moiré Fringes for Measurement and Control," and welcome any inquiries on the subject which should be addressed to "The Director" at either the NPL, Teddington, or the NEL, East Kilbride, Glasgow. As applied at the exhibition, practical accuracies of measurement to within 0·0001 in. over lengths of 36 in. or more are obtainable with little difficulty.

Spark machining

Another comparatively recent machining process, which is now being widely applied, is spark machining. Although it is only a few years since this process was first introduced, several firms at the exhibition are offering production machines, some of which, like the "Sip-Agie" unit, have incorporated co-ordinate control. This particular machine, a product of the Société Genevoise Ltd., of Newport Pagnell, Berks, is designed for the production of punches and dies for watchmaking requiring an accuracy of centre distance of 0·00008 in.

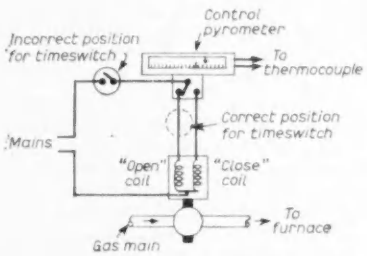
Electric furnaces are also in evidence, notably on the stands of AEI-Birlec and Wild-Barfield. Arc-welding equipment, too, can be seen on a number of stands, an interesting unit being the "Arcmaker," a silicon rectifier transformer set by the Lincoln Electric Co. rated at up to 300A, 35V intermittent hand welding.

PROBLEMS AND PRACTICE

We welcome contributions to this feature; those published will be paid for at our standard rates. There must be many problems encountered in day-to-day electrical work, or useful ideas or tools devised to make it easier; all make instructive reading.

Oil-fired Boilers

THE recent notes by "Michet" (16 June issue) on oil-fired heating installations reminds me of a danger which can arise in both oil- and gas-fired boiler installations with electric control through valves by thermostats or pyrometers augmented by time switch. To quote an experience some years ago with an industrial gas-furnace which I was called upon to visit after it had "run-away" one Friday evening, I discovered that the makers had issued a drawing and the equipment had been installed with the time switch in the main supply line to the control unit. It so happened that, on this evening, the switch had operated to cut the furnace off for the week-end when the gas valve was opened, so there was no current to shut the valve when the pyrometer



Right and wrong positions for time switch in auto-controlled gas- or oil-fired boiler and furnace installations

reached cut-off temperature. Fortunately, an inquisitive watchman had noticed that the furnace was still alight when he came on duty and called the shop manager who shut off the gas valve. In such circuits it is imperative that the time switch be inserted in the "open" line leaving the "close" line permanently energised, as the diagram shows.

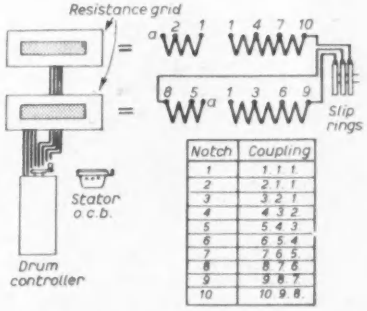
In regard to the burnt-out coil problem, I, too, have had a similar experience but, being by nature somewhat lazy in inclination, I didn't bother to count the turns but mounted the burnt-out coil on a mandrel alongside the bobbin for the new coil and then proceeded to wind the wire on to one as I unwound the other. It happened that the gauge of the wire on the damaged coil was strong enough to act as a drive when the mandrel was supported between pin-bearings, so all that I did was to pull it and the new coil rapidly wound itself to the right number of turns automatically.—*"Polyphase."*

Freshened Air Tip

A FACTORY inspector (electrical) once remarked to me that he could tell what the electrical section was like by a glance in the workshop. Agreed, the variety of jobs which have to be handled and the amount of dismantled equipment around does make it difficult to maintain a clear and orderly shop, but, what is worse, the atmosphere is all too often stuffy and unpleasant, what with the fumes from soldering, varnishing, stoving, burnt insulation from damaged motors, etc., which can become almost unbearable on a hot summer's day particularly if, as in our workshop, a 300 kVA transformer is in an adjacent cubicle. When it gets too bad, in the evenings when clearing up and in the mornings when preparing for the day's work, we switch on a little device of our own for a short while. Nothing very elaborate, but just the blower for cleaning out motors to which we have added a perforated tin can to the air intake in which there is a block of deodorising camphor used for air purifying. The effect is amazing and, though the shop is not always as tidy as we would like despite our efforts, I'll bet that factory inspector won't notice it as much as if the atmosphere is its usual thickness! —*F. R. Ralph.*

A Missing Link

WHEN installing electrical gear it is not always possible to rely upon the accuracy of manufacturer's drawings of connections. Some years ago I had to supervise the installation of an air conditioning plant driven by a 120 h.p. slip-ring induction motor in which the ten speeds of the multi-vane compressor were obtained by shorting out one stage



Notch	Coupling
1	1.1.1.
2	2.1.1
3	3.2.1
4	4.3.2
5	5.4.3
6	6.5.4
7	7.6.5
8	8.7.6
9	9.8.7
10	10.9.8.

A missing link in a motor circuit was responsible for a startling "run-away." Bridging terminals a and a removed the trouble

of each phase in the rotor circuit at a time by means of a drum controller. This was connected to two resistance grids mounted on the wall above the controller by bare ¾ in. copper rods which were installed exactly to the maker's drawings. On a test run, the motor started up slowly on the first notch but little difference in speed was noted until the fifth notch was reached when the motor "ran away" in an alarming manner and the stator circuit-breaker was instantly tripped as a safety precaution. A check having been made that the connections were actually as called for, I examined the grids and traced out the circuit. The fault then became plain; there was a missing link which left one phase open-circuited until the fifth notch was reached. I gave instructions for it to be inserted and this was done with a certain amount of trepidation by the electrician who still had more faith in the drawing than in me—in fact I had to start it myself, "just in case!" However, it started sweetly and accelerated smoothly by equal steps as the controller handle was advanced and, with it, my reputation with at least one member of my staff.—*C. Jenkins.*

Intuitive fault finding

NOTHING can be more infuriating to a mains engineer than to find all his pet methods of locating a mains fault, sometimes with most expensive equipment, a complete failure and then to meet someone who "has a nose for it" pinpoint the vital spot with unerring accuracy. I was once in this position trying to locate a fault on a two-mile length of 3-core 3 kV cable between two substations which had completely burned through all three cores making a loop test impossible. Reduced to the expedient of opening up half way, cutting and testing and then "halving" the faulty section, I had made three such breaks when I turned to find an old, well-known and experienced mains foreman watching with a half-tolerant smile. "Not so easy this time is it?" he remarked, somewhat obviously. Stung to a retort, I replied, "Well, where would you try next?" He thought for a moment and then pointed to a spot which he had selected for the sole reason, he afterwards told me, that there was a piece of old sacking lying there. Thinking that this was as good as anywhere I told the boys to open up. Believe it or not, there was the fault! —*Ion.*

for the electrical trade

Infra-red heaters

SOFONO infra-red heaters will be available under the trade name "Jupiter" in the autumn. The range comprises models for wall, or pendant fitting and portable units with 750 W ratings. These "Jupiter" fires have an unusual design in end castings; a crescent shape rather like an angel fish. The element is guarded by a chrome-plated perforated shield.

The wall and portable units, IRW 75 and IRF 75, are priced £5 7s 9d and £6 18s, respectively, tax paid. The pendant IRP 75 is for commercial applications, priced £4 5s; 1,500 W models of all these units will be available by 1961. *Sofono Electrical Division, Federated Foundries Ltd., 4 Stratford Pl, W.1.*

Flower lights

THE increasingly popular plastic flowers have been used to form an effective illuminated decoration now available. Roses or tulips of one or more colours are placed in black pottery vases, each "bloom" carrying a small electric bulb within it. When alight, we are told, the flowers release an elusive scent. These sets have the obvious advantage of an attractive appearance whether they are lit or not. The roses retail at £2 19s including purchase tax, the tulips £1 19s. *Fenny Electrical Co., 33 Aylesbury St, Bletchley, Bucks.*

Espresso for all

AN Austrian coffee maker, "Stella," being distributed in this country offers espresso lovers the real thing in their own homes. There are two models, 275 W and 550 W, the smaller producing three small cups of coffee at a time, the larger six. The pot supplied with the unit is heated at the same time as the holder to ensure best results. Another useful feature is a fine metal filter which dispenses with the filter papers usually employed. A "Bakelite" base prevents the hot stand from damaging furniture. "Stella" retails at £4 19s tax paid for the small model, 402E, and £8 17s tax paid for the larger, 405E. *Bevalite (Birmingham) Ltd., 212 Hurst St, Birmingham.*

Warm-glow convectors

HOTPOINT have introduced two new 2,000 W convector heaters for domestic use, which contain decorative lighting units. One has a two-heat switch, the other, thermostatic variable heat control. Both cabinets are square faced with rounded edges and with grids at the top front. They are finished in grey, blue, hammered bronze or a red, with black feet. The lighting unit is a concealed bulb which sheds a glow through the grill and onto the floor. The thermostat model, No. 6035, is priced at £9 18s 6d tax paid, the switch, No. 6030, £8 19s 6d. *AEI-Hotpoint Ltd., 33 Grosvenor Pl, S.W.1.*

TRADE PUBLICATIONS

DCMC.—Eight-page technical leaflet and price-list on industrial aerosols including silicone mould release, cutting oil, rust-inhibitor, lubricating oil and clear lacquer. DCMC Industrial Aerosols, 2a Parkhurst Rd, London N.7.

SILVAWAY, LIGHTERWAY and SILVER-LUXE.—20-page catalogue/price-list of lighting fittings and hand lamps. Metway Electrical Industries, Canning St, Brighton.

MULLARD.—Leaflet on microwave valves incorporating output and frequency chart. Leaflet on cadmium sulphide photoconductive cells for industrial purposes. Government and Industrial Valve Division of Mullard Ltd., Mullard Hse, Torrington Pl, W.C.1.

French wash/spin combination

TWO more combined washing machines and spin dryers are available from France, "Norine" and "Vestalux," manufactured by Conord. The former is a 7 lb capacity model mounted on rollers and finished in white vitreous enamel. It washes and rinses by agitator action and spins dry in the same tub. The controls are mounted behind a neat panel near the bottom of the front face. Washing and rinsing times can be selected.

The other machine, "Vestalux," is similar in operation, but has a six-bladed agitator and the more modern "desk" top, with controls in the raised ridge at the back. Its capacity is 10 lb. This cabinet has a lid, finished in porcelain, which is counter-balanced on hinges.

Both these appliances have 3 kW heaters and centrifugal pumps for rinsing and emptying. Dimensions are: "Norine," 31 in. high by 17½ in. wide by 17½ in. deep; "Vestalux," 35½ in. high, 24 in. wide and 25½ in. deep. Prices, £72 9s and £115 10s, respectively, including purchase tax. Distributed by *Electro Appliances and Equipment Ltd., Mitre Hse, 177 Regent St, W.1.*

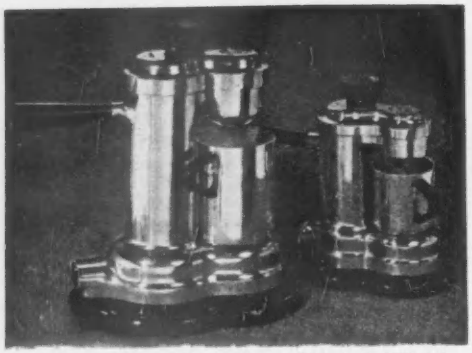
GEC 'fridge price cut

GENERAL ELECTRIC CO. announces that the "Fabulous Four" refrigerator is reduced in price by £6 13s 3d as from 1 July. This 4 cu ft model now costs £66 3s including purchase tax.

Low cost drink mixer

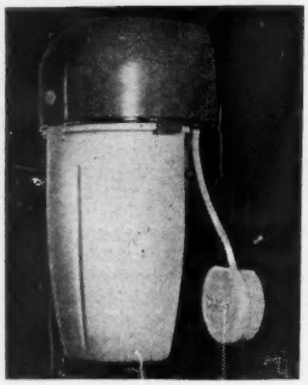
A NEAT wall-fixed drink mixer has been introduced at the remarkably low price of £2 16s 8d tax paid. This handy appliance does all the beverage preparation work of much more expensive full-scale food mixers.

The motor, housed in a smooth, coloured casing, is fixed to the wall, and the beaker gripped in place under the mixing head, as shown in the illustration below. Push-button control puts the unit into operation, though as a safety precaution a switch is incorporated which allows the motor to run only when the beaker is pushed into the correct position. "Whippet," available in a number of colours, will be handled through distributors. *Howard Foss, Belvedere Works, Totton, Southampton.*



"Stella" espresso coffee makers, 550 and 275 W, £8 17s and £4 19s

Fenny's illuminated rose set, with built-in perfume £2 19s



"Whippet" the £2 16s 8d drink mixer

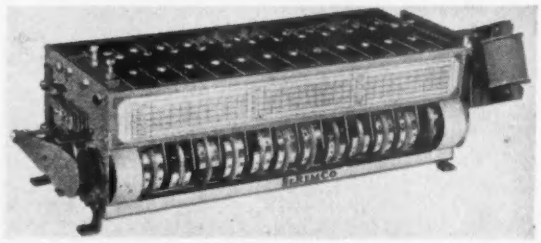
equipment for industry

Finger tightening a 1 in. nut

MORE than twice the pressure obtained with the traditional spanner —and perhaps an additional blow from a hammer—is claimed for the pressure exerted by a finger-tightened hydraulic nut. The nut is made in two sections joined by a leak-proof seal which permits slight movement. A special compound forces the two sections of the nut apart slightly when an Allen key in one half of the nut is tightened. Tests on a 1 in. BSF nut, screwed hand tight, showed a clamping pressure of 4 tons p.s.i. when the Allen key was finger tightened. Releasing the Allen key enabled the nut to be removed effortlessly. These hydraulic locking nuts are available in sizes from ¼ in. to 2 in. diameter for Whitworth, American, unified and metric threads. The body of the nut is formed from high tensile steel and it is said that the clamping pressure is maintained indefinitely. *Euco Tools Ltd., 44 London Rd, Kingston, Surrey.*

Timer control switches

THREE multi-circuit motor-driven time switches have been introduced recently to meet requirements for automatic sequence control of several circuits in industrial applications. All three timers may have 4, 8 or 12 independently adjustable timing circuits, each with a drum dial for presetting timing of a particular operation. Time ranges from 0-6 secs to 0-6 hours are available, and the contact capacity is 15 A at 230 V a.c. or 3 A at 415 V a.c. The timers have been designed to permit quick alteration of range by changing motor and gears if required. In the first type of timer, Ref.: MAT/RM, repeated cycling in either forward or reverse direction is possible, or it can be arranged for automatically resetting to zero after a complete or partially complete timing cycle. All switching circuits return to rest position within ½ second after de-energising the drive solenoid and the timing mechanism itself resets to zero position within one second. On Type MAT/RS, the electro-magnetic clutch is normally engaged and the timer resets to zero position only when the clutch solenoid is energised. Resetting times are similar to those with Type MAT/RM. Features of both these timers are combined in the Type MAT/RM/RS, which has a reverse acting electro-magnetic clutch and reversing motor. The Type MAT/RM timers would permit closing of a number of electrical circuits at preset times and then opening them in reverse order if required, and also setting to zero position within one second, either of a given signal, or in the event of power failure. Such a timer could be used for switching off excess loads in sequence in conjunction with a maximum demand meter. *Electrical Remote Control Co. Ltd., The Fairway, Bush Fair, Harlow, Essex.*



These ELREMCO sequence timers can have 4, 8, or 12 ways, each with independent setting

New "modular" electronic instruments

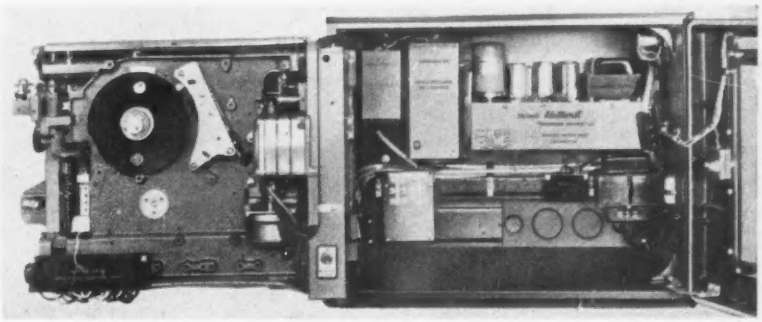
BY constructing their new range of "electronik" instruments on the module principle, Honeywell Controls claim that they have achieved simpler servicing and improved versatility. The instruments are built up from four quickly changeable sub-assemblies consisting of a constant voltage unit, measuring circuit unit, balancing motor and amplifier. An electronic strip-chart recorder controller, illustrated below, shows how the module units are incorporated in the instrument. Fifteen amplifier units are available with plug-in facility to enable quick selection for input impedances between 400 and 50,000 ohms. Good voltage stability is said to be obtained by using Zener diodes for regulating the instrument supply. The voltage is claimed to be within ±0·03% for line variations up to ±10%. The measuring module has a clip-on resistor panel to enable the ranges to be easily changed and the only other alteration required is fixing a new chart or scale. These sub-assemblies, in addition to being used in the new electronic range of instruments, can also be used in existing instruments with the exception of the measuring unit. *Honeywell Controls, Ruislip Rd East, Greenford, Middx.*

Breaker trip indicating relays

SUPERVISORY relays, which give audible alarm and visual indication if a circuit-breaker trip circuit fails have recently been introduced by English Electric. One of these relays will supervise when a circuit-breaker is closed, while, if it is necessary to supervise the breaker either open or closed, the second relay can be used. Both relays have approximately 400 millisecond time delay to avoid indication during a fault or normal circuit-breaker operation. These relays are suitable for supply voltages of 30, 110, or 240 volts d.c. and they are provided with resistors for series insertion in the trip circuit to limit fault current in the event of a

The Euco hydraulic nut. Rotating the Allen key is claimed to give a more powerful clamping action than tightening with a spanner

A "Module" construction has recently been adopted for Honeywell "Electronik" instruments. The illustration shows the rear of an electronic strip-chart recorder with constant voltage unit, measuring circuit, and plug-in amplifier. The sectionalised motor is inside the swing cover



short-circuit in the relay connections. *English Electric Co. Ltd., Marconi Hse, Strand, W.C.2*

Hopper level switches

TWO level-controlling switches have been introduced recently in which pressure on a synthetic rubber diaphragm actuates a single-pole microswitch through a spring-loaded plunger. The diaphragm will respond to pressure of granular or similar materials collecting in a hopper. One of the switches is intended for use in an open hopper, the other is specifically designed for level control in pressurised containers. To avoid spurious action of the limit switch in the second case, air pressure in the container is applied through a flexible membrane to the back of the level switch diaphragm so that this diaphragm is pressure balanced. *Firth Cleveland Instruments Ltd., Treforest, Glamorgan.*

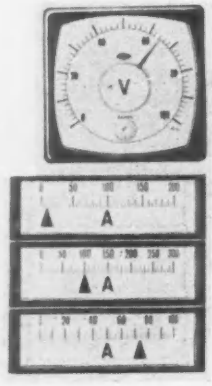
Clear and compact metering

DETAILS of three new designs of meter, recently added to the range of instruments made by The Record Electrical Co., have just been released. They are moving iron and moving coil meters with a square panel mounting bezel, and a series of compact "Edgewise" meters specially designed for mounting in groups.

The "Cirscale" moving iron and moving coil meters have robust steel panel bezels linked through a dust-tight joint to the moulded body. Platform scales, finished in matt white enamel, are used for both types of instruments, although flat dials can be supplied. Clear, high accuracy reading is possible with the slender dagger-type pointers which move over a scale approximately 5 in. long. A feature of the moving iron instrument is that momentary overloads of several times the f.s.d. can be applied without damaging the instrument, although for frequent overloads scales having a full-scale deflection six times the normal value, but compressed into only a quarter of the scale length, can be provided. Standard ranges for the moving iron meters extend from 10 mA to 30 A on the current range or 10 V to 750 V for the voltage range. Moving coil meters range from 1 mA d.c. to 50 A d.c., while the voltage range is from 50 to 750 V.

Overall dimension of these meters are 3½ in. square with 2⅛ in. diameter body. OBA terminals are provided.

Compact designs of the "Edgewise" meters permits three of these to be grouped in a square of 7 in. side. These instruments have a curved platform scale for easy reading, but the front glass is flat giving minimum projection from the mounting panel. The instruments are available with voltage ranges up to 750 V and current ranges from 150 micro A, on d.c. A.C. rectifier ammeters are self-contained up to 30 A. All these instruments comply with BS requirements for accuracy. *The Record Electrical Co. Ltd., Broadheath, Altrincham, Cheshire.*



New instrument introductions by Record Electrical. "Cirscale" moving iron and moving coil meters with 3½ in. square bezel, and "Edgewise" moving coil meters intended for compact panel grouping

Electronic tachometer

ELECTRONIC tachometers, claimed to measure shaft speeds to an accuracy of ±1 r.p.m. and using either four or five dekatron tubes are available from Pentechnique Ltd. The counters have provision for several input signals and up to 10 timing periods can be selected by means of a rotary switch. Features of the counters are said to be easy access to all components and the use of special quality valves and high stability resistors to ensure reliability. Photo-electric and magnetic transducers can be supplied for use with tachometers. *Pentechnique Ltd., Imperial La, Cheltenham, Glos.*

High efficiency filtering media

HIGHLY efficient filtering under critical conditions is claimed for two recently introduced filtering media, "Poroloy" CM and T. The Poroloy filters are formed from stainless steel, although many other metals may be used provided they can be drawn into fine wires. A sintered construction ensures that the filter will withstand sudden pressure surges and severe vibration by securely bonding wires at all points of contact. Units are available in a variety of shapes and sizes for withstanding differential pressures up to 3,500 lb/sq in. and temperatures from −350°F to above 500°F. The filters are said to be suitable for an extensive range of materials varying from acids and nuclear fluids to gases and lubricating oils. The nominal pore size of the filters ranges from 2 to 1,000 microns. *Vokes Ltd., Henley Park, Guildford, Surrey.*

Quick response thermometer

A COMPACT and portable electrical thermometer operated from a battery has recently been announced. The "Mavotherm" is a German-made thermometer said to be suitable for rapid and accurate temperature measurement under laboratory or workshop conditions. The instrument has two ranges covering temperature differences from −20 to +200°C and calibrated probes are supplied especially designed for use in difficult locations. The instrument reading time is said to be between 3 and 4 seconds with an accuracy of ±2°C. It is mounted in a strongly built plastics case which can be easily held in one hand. The thermometer will measure the temperature of solids, liquids or gases. *Aveley Electric Ltd., Ayron Rd, Aveley Industrial Estate, South Ockenden, Essex.*

Cold curing rubbers

MANY applications arise, particularly in the production of delicate electronic instruments, when a protective coating is required which can be applied at room temperature. Suitable for such applications are three silicone rubbers introduced by ICI under the name "Silcoset." Although accelerated curing is possible by heating the rubbers, they will cure at room temperature and the curing time can be varied. The rubbers are also suitable for sealing and caulking and can be applied by knife coating to a wide range of organic and inorganic fabrics. They form a non-stick coating which has good resistance to weathering, water and corona discharge and is stable over the temperature range from −60°C to +250°C. Typical electrical properties of the three grades are an electrical strength of 500 V/mil and a volume resistivity of 10^{13} ohm-cm. *ICI Ltd., Imperial Chemical Hse, Millbank, S.W.1.*

Time-delay mercury switch

A THREE-POLE 20 A change-over switch employs mercury tubes to give reliable operation. Operation of these three switches in unison is ensured by the quick make-break action produced by a single operating solenoid. A control mechanism enables cams operating the switches to vary the operating time from zero to 100 secs. *Mercer Pneumatic Tools Ltd., Staygate Works, Rooley La, Bradford 5.*

Pipework planning

A BOOK recently published entitled "Industrial Pipework" contains a variety of useful information for those planning pipework installations. After detailing the range of pipe products and joints made by Stewarts and Lloyds, useful information is given on methods of supporting pipes and calculation of their size. Among the many tables are listed weights and dimensions of steel pipes and dimensions for bends. Graphs are included showing losses with water and steam flow. *Stewarts and Lloyds Ltd., Pipework Engrg. Divn., Broad St Chmbrs, Birmingham 1.*

High accuracy process timer

FOR applications where exceptionally close tolerance on a timed circuit is required, Elcontrol have added to their range a new timer, TRU4. This is claimed to give repetitive timing to within ±0·1% for normal mains variation and only ±0·25% for ±25% mains variation. Relay contacts are rated at 5 A 250 V a.c. The timer unit is mounted in a dust- and moisture-proof case with remote mounting control housed in a cast iron box. *Elcontrol Ltd., Wilbury Way, Hitchin, Herts.*

News of the Week

CUT-PRICE EMPIRE-MADE ACCESSORIES

Mr S. Goldstone, W. and G. chairman, protests at increasing influx of lampholders, ceiling roses, plugs, sockets

UNRESTRICTED importation of "Empire-made" electrical accessories produced in the Far East is causing concern to British manufacturers. The latest to draw attention to the increasing trend is Mr Sampson Goldstone, chairman of Ward and Goldstone Ltd. He complains that such imports, produced where labour rates are commensurate with the lower living standards of the workers in those areas, imposes an unfair handicap on all those employed in the industry.

Unless a corrective duty is applied, as is practised in some Dominion markets, the influence on employment and profits might well be serious, he declares.

In addition to the application of a differential duty, Mr S. Goldstone wants these goods to be marked "Made in Hong Kong," he told the ELECTRICAL TIMES this week.

For these "Empire"-made accessories —from lampholders and ceiling roses to plugs and sockets—all come from Hong Kong—and price-cutting applies particularly to lampholders, being very severe for the push-button type, we understand. These are being offered to manufacturers of lighting fittings at around 5s a dozen cheaper than the home product, the ELECTRICAL TIMES was told by another manufacturer earlier this week.

Some of the large stores are handling the accessories and, although prominent electrical wholesalers refuse to touch the importations, efforts are being made to get some of the smaller wholesalers to stock them.

ZEBRA for WINFRITH

A ZERO energy fast reactor named "Zebra" (Zero Energy Breeder Reactor Assembly) is to be built by the UKAEA at Winfrith Atomic Energy Establishment. The reactor has been designed to permit the study of neutron physics for a wide variety of fuel assemblies containing uranium and plutonium.

The assemblies under study will be built up by loading fuel elements into a steel matrix (approximately a cube of side 10 ft). The fuel elements contain both fuel plates and plates of neutron absorbing material, and the latter will be used to simulate the nuclear properties of the coolant and structure material which would be required in a power reactor.

Zebra will be operated at room temperature and the heat output will be kept very low so that no cooling system is necessary. It is planned to commission the reactor during 1962. Zebra will be used to obtain information needed for the design of a prototype likely to be the next step in the development of a fast reactor by the authority.

U.K. - Sweden phone link

THE first direct telephone cable between the UK and Sweden is now being installed between Middlesbrough and Gothenburg. It is claimed to be the longest submarine telephone cable system in Europe and is, to date, the longest in the world using a single cable for both directions of transmission.

Standard Telephones and Cables have supplied the cable underseas and submerged repeaters for the 530 nautical miles across the North Sea, to the order of the GPO. The cable was manufactured at STC's Southampton plant and fed straight from the factory to the cable ships "Monarch" and "Ariel." The 29 submerged repeaters were made at the STC North Woolwich factory.

Final testing and commissioning of the system will be carried out by the GPO and the Royal Swedish Board of Telecommunications. The system is expected to be in service by October.

PAY RISE: *Tribunal's Award*

INCREASES in pay ranging from £20 p.a. for those on the lowest grade of the general clerical scale to £215 at the top of grade ten for higher clerical, administrative and commercial staff in the electricity supply industry has been awarded by the special Arbitration Tribunal. In one step of grade nine the increase goes up to £235. The increases are back-dated to 1 Dec., 1959. This is the claim which the NJC committee referred back to the tribunal to implement their own award made last November.

The higher clerical, administrative and commercial staff scale now starts at £600—an increase of £75—for Grade I, extending to £700; and the top salary in grade 10 is raised by £215 to £1,800.

In its award, the tribunal have lengthened by one step the General Clerical Scale, the Shorthand-Typing and Machine Operators (1) Scale and the scales for Grades 3, 4 and 5, and have reduced by one step the scale for Grades 8 and 9.

At their meeting on 19 July, the National Joint Council will be asked to determine a new progression limit for demonstrators and the application of the award to employees with protected salaries.

Outer Seven Cut Tariffs

THE first of the planned tariff cuts between the seven member countries of the European Free Trade Association came into effect last Friday (1 July) with a reduction of 20% in import duties (other than revenue duties) on goods eligible for area tariff treatment.

At the same time another provision of the Stockholm Convention came into effect, namely, that bilateral quotas for EFTA were to be "globalised" (i.e., added together and opened to all) and increased by 20%. Where quotas are nil or negligible, the basic quota will be set at a reasonable figure and increased by 20%. Since most imports are already free from quota restrictions, the quota increases will affect the market less than the tariff cuts.

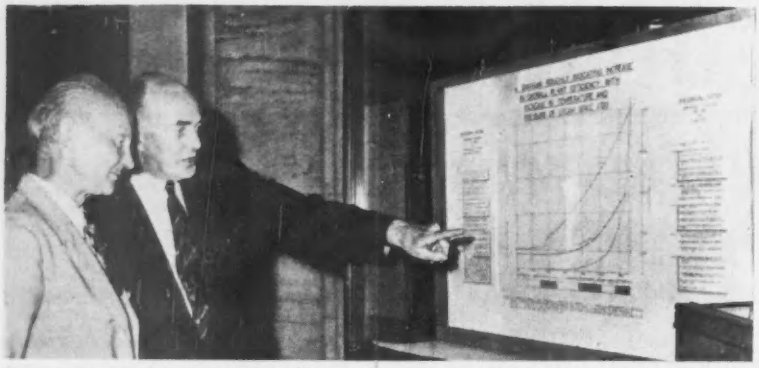
In 1958 electrical machinery, appliances and cars accounted for nearly a third of the EFTA areas imports of engineering products. The UK supplied 13% of the market for electrical machinery and appliances. Total engineering imports of EFTA countries outside the UK in 1958 were valued at £754 million—nearly three-quarters as much as imports by the Common Market countries.

Six cut tariffs, too

ON 1 July the six countries of the European Common Market made their second tariff reduction, this time by 10%. A further cut of 10% is scheduled for 1 Jan. next.

'Judge' trade mark acquired

PRELIMINARY negotiations with the receiver for Ernest Stevens Ltd., in respect of the "Judge" trade mark have now been completed by Jury Holloware Ltd. The latter plan to purchase the trade mark, goodwill, designs and sole manufacturing rights and distribution of "Judge" brand enamelled and stainless steel holloware, with certain plant, loose tools and patterns.



Sir Hamish MacLaren and Sir Willis Jackson, president-elect and president of the IEE, respectively, examine a display of ERA work on the properties of steam. The Association has been concerned with work in this field since 1922, much of the investigation being undertaken at Imperial College. Dr B. Whitney, of the ERA, has been responsible for co-ordinating this work. The IEE display has been organised in conjunction with Imperial College and Queen Mary College

4-day week for G.E.C. cooker works

A FOUR-DAY week came into operation on Monday last at the Swinton (Yorks) cooker works of GEC Ltd., where the labour force numbers 1,200. The company say that "an unsatisfactorily high stock position has made it necessary to reduce output and costs." The decision to go on short-time working will avoid possible redundancy dismissals of about 300 workers.

Hire-purchase restrictions are not wholly blamed for the cut-back; the trouble is also due to unexpected sales resistance to a new cooker recently introduced with only two hotplates instead of the more usual three. Although cheaper, the new model is apparently not achieving its estimated market and a high stock position has made it necessary to cut production and operate a shorter working week.

Apart from Cannon, who took similar action in the gas-cooker field due to the effect of the h.p. curb on a new rotisserie model, the cooker industry generally has not suffered any appreciable fall in demand as a result of the recent credit restrictions. The terms for cookers are a deposit of 10% with repayments over four years, compared with 20% down and two years to pay for other appliances such as refrigerators and washing machines.

Delay on 275 kV Grid Towers

WORK has been held up on the two 630 ft steel towers, claimed to be the second highest structures of their kind in Europe, at present under construction to carry a 275 kV grid power line across the River Thames between Swanscombe, Kent, and West Thurrock, Essex. About 500 ft of the towers have been completed, but it has now been decided to change the design of the top section, including the line-bearing arms, to cope more effectively with ice and gales.

The modification requires special steel which is not readily available and, in consequence, the towers, originally due to be completed by September next, will not now be finished until next year.

£90,000 French Contract

A £90,000 order for automatic control equipment for a new zinc smelting plant to be erected at Noyelles-Godault in Northern France has been placed with the Industrial Weighing Division of Elliott Brothers (London) Ltd. The order brings the total of recent contracts for Elliott control equipment for zinc smelting plants to over £250,000.

Factory Expansion Plans

THE new factory and offices of the Kingston Lamp Co. Ltd., in Jenning St, Hull, were formally opened a few days ago by the Lord Mayor of Hull. Formed in 1946, the company make various types of tungsten lamps. There are plans for a second stage development, of a further 12,000 sq ft, for which instructions have been given for drawings to be prepared. A third stage to complete development of the site will cover 26,000 sq ft.

Scheduled for occupation in the autumn, the new factory and administration block of Sifam Electrical Instrument Co. Ltd., at Leigh Court, Higher Lincombe Rd, Torquay, is now beginning to take shape. It will consolidate and centralise the resources of the company's existing two plants and employ approximately 275 people in the manufacture of electrical measuring instruments. Two areas of the new plant will have special air-conditioning equipment. The company has an option on an adjoining site for further development.

T.I. Win Stand Award

THE Tube Investments stand at the British Exhibition, New York, was co-winner with the Worshipful Company of Goldsmiths in a contest to select the best-designed display during the run of the exhibition. The contest was sponsored by the Worshipful Company of Goldsmiths. The judging panel cited TI for "interesting use of less dramatic subject matter."

The stand, designed by Mr Leslie Gooday, London architect, was organised by TI (Export) Ltd.

1959: *YEAR OF INCREASING INDUSTRIAL ACTIVITY*

ALTHOUGH 1959 started with nearly 621,000 registered unemployed in Britain, the highest number recorded since 1947, the year was notable as one of rapidly increasing industrial activity culminating in November with a record total working population estimated at 24,385,000, including 23,432,000 in civil employment. Overtime had risen to a very high level, and short-time working had fallen by the autumn to one of the lowest levels ever reached.

Moreover, states the annual report of the Ministry of Labour for 1959 published last week, despite the normal seasonal deterioration between November and December, both the total working population and the number in civil employment were still higher at the end of the year than in any previous year.

Women and girls accounted for almost the whole of the increase in the working population.

The absorption of 48,000 more school-leavers than in 1958 presented no widespread difficulty, and the number of young people entering skilled occupations increased—119,000 compared with 110,000 in 1958—thus maintaining a proportion of 21% of those going out to work for the first time.

The total of 5¼ million working days lost through industrial disputes was over 50% higher than in 1958, but this was more than accounted for by 3½ million days lost in the national printing strike. Increased wages and reduced working hours were the commonest subjects of negotiation. Nearly 4¼ million wage earners had their weekly rates increased and about 357,000 had their normal working hours reduced by an average of 1½.

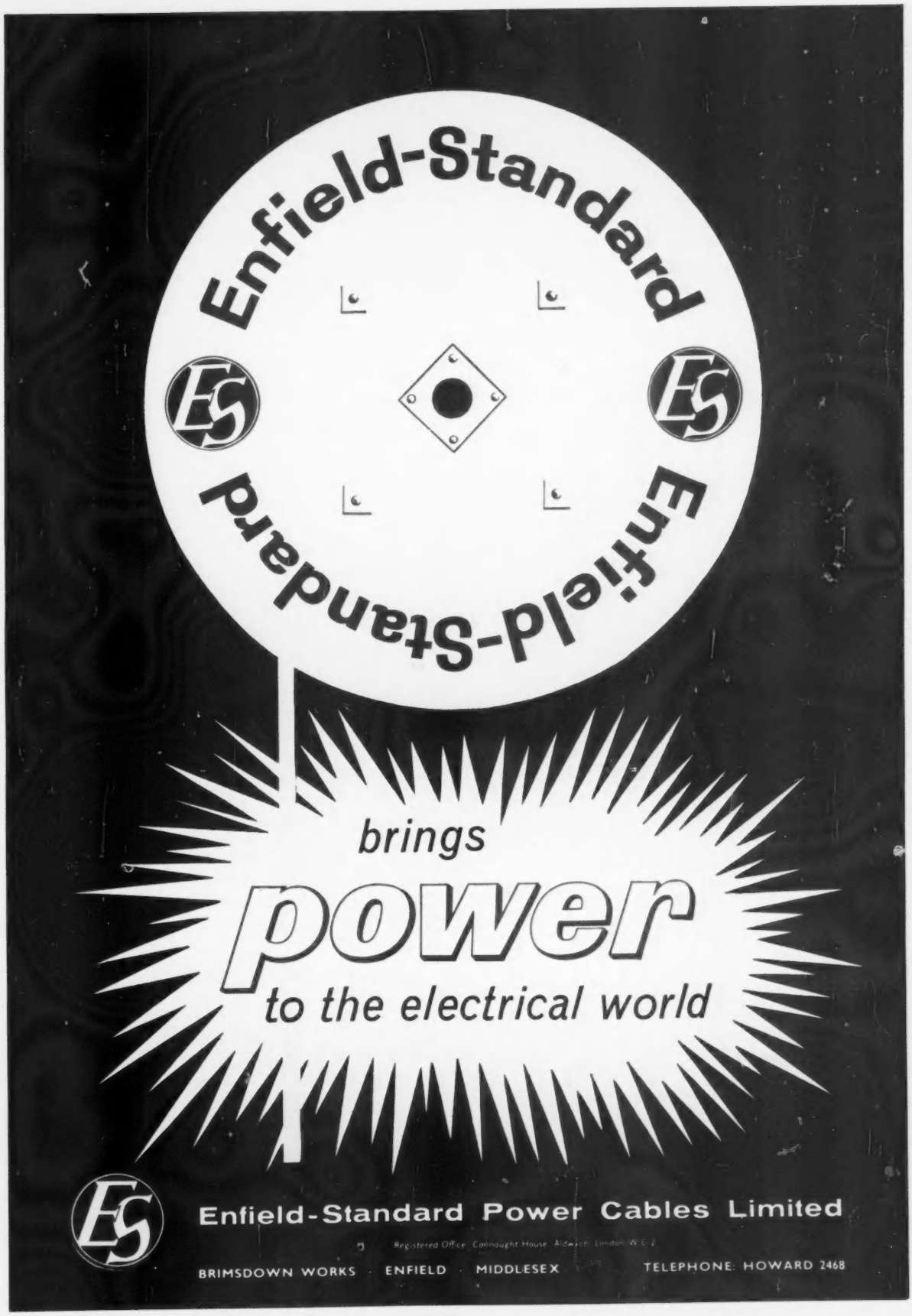
OFFICIAL PUBLICATIONS

Alkali, &c, Works. Annual report by Chief Inspectors, 1959. HMSO. 4s. (See page 34.)

Ministry of Labour Report for 1959, Cmd. No. 1059. HMSO. 7s.

Noise in Factories. Factory Building Study No. 6. HMSO. 3s 6d.

BS 3249. Cables and Flexible Cords Insulated with Varnished Cambric and Heat-resisting Fibre. 5s.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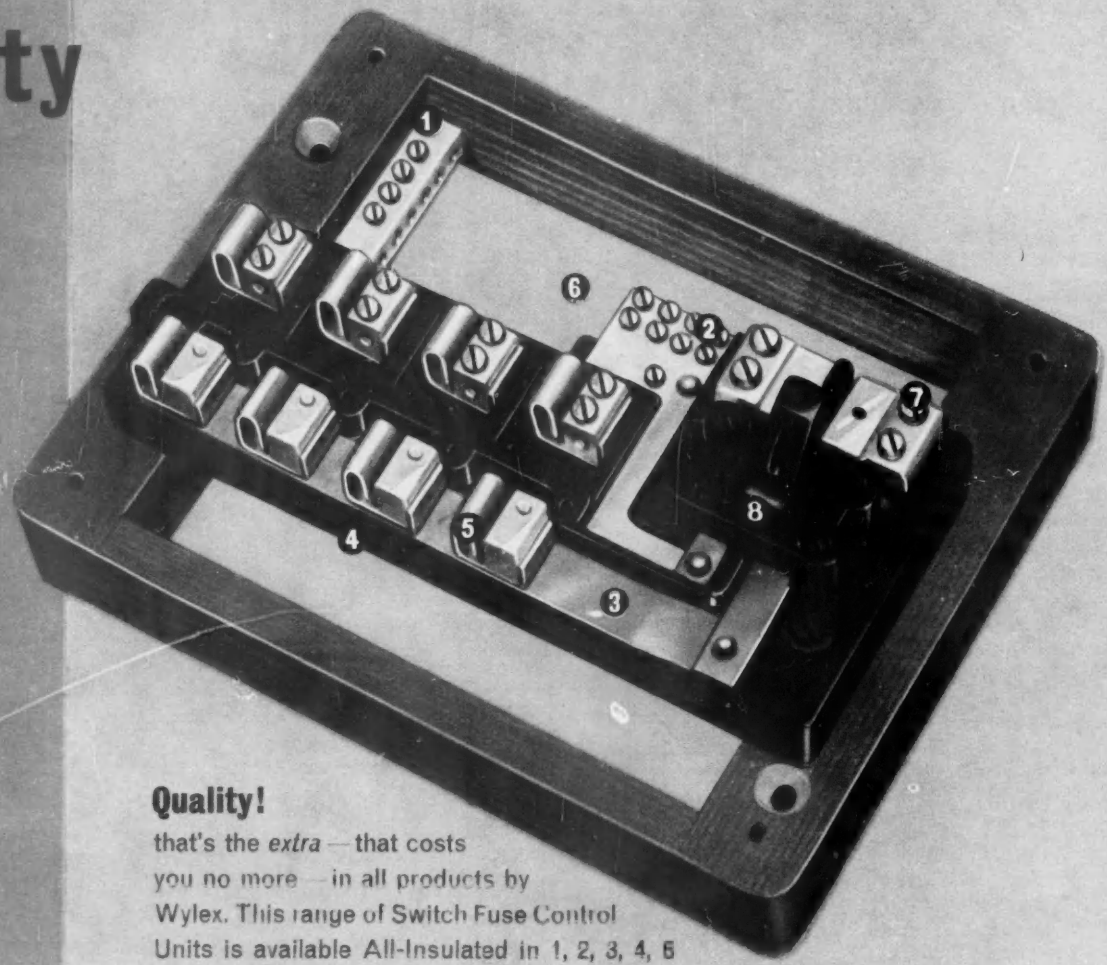
Wylex build *into Switch Fuse Control Units* quality



1. Earth Bar always provided.
2. All Terminals easily accessible.
3. High grade electrolytic copper Bus-Bar.
4. Current-carrying components mounted on non-track Mouldings.
5. Fuse Contact Clips of Special design to ensure positive contact.
6. Ample wiring room.
7. Screws have domed ends — cannot cut into cables.
8. Incorporates WYLEX Switch — proven by years of extensive service.

Quality!

that's the *extra* — that costs you no more — in all products by Wylex. This range of Switch Fuse Control Units is available All-Insulated in 1, 2, 3, 4, 6 and 8 way and Metalclad 3, 4, 6 and 8 way, 250v. S.P.&N. Especially easy to stock and make up, to any combination of fuses — rewirable or cartridge. Features the *proven* WYLEX switch with silver-to-silver contacts and sturdy mechanical components.

Wylex Distribution Boards

contemporary to the range of Switch Fuse Control Units available in 4, 6 and 8 way. All-Insulated and Metalclad.

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GEORGE H. SCHOLES & CO. LTD. Wylex Works, Wythenshawe, Manchester 22

MERGERS . . . ACQUISITIONS . . . TAKEOVER BIDS

DEVELOPMENTS IN INDUSTRY

Simms acquire Dawe Instruments

THE Simms group of companies is to acquire "for a sum in the region of £¼ million" the issued share capital of Dawe Instruments, of Ealing, and their associated company, LMK Manufacturing Co. Ltd. of Brentford, it was announced at the a.g.m. of Simms Motor and Electronics Corporation Ltd. last Friday.

The board of Dawe Instruments is reconstituted as follows: G. E. Liardet (chairman), F. W. Dawe (managing director), J. Ayres, M. A. Hassid and K. G. Smith. Messrs E. C. Kent and A. D. Wells have resigned. The company specialise in the application of electronics for all branches of industry, and have earned a high reputation for their sound and vibration measuring instruments, stroboscopes, dynamic balancing equipment and ultrasonic cleansing and gauging equipment. A range of fully transistorised instruments for industry is in an advanced stage of development.

With this acquisition Simms expand still further the electronic interests of their group which was only recently augmented by the purchase of Cawkell Research and Electronics Ltd. To finance group expansion and development the company are to make an issue of 5s Ordinary shares to raise £850,000 capital.

Consortium v. Pye in bids for Temco

A CONSORTIUM of seven major electrical companies has made a joint £2,225,000 cash bid for control of the Telephone Manufacturing Co. against an earlier share bid by Pye Ltd. valued at £2,450,000.

The seven companies are AEI, Automatic Telephone and Electric, Ericsson Telephones, GEC, Marconi W/T Co. (owned by English Electric), Plessey and Standard Telephones and Cables. The consortium offer is 12s 6d cash for each 5s Ordinary Temco share. Pye are offering four shares worth 17s each for every five Temco Ordinaries.

Next move is from Temco who must guide shareholders on the merits of the two offers. The company manufacture telephone and telecommunication equipment.

Dutch Stokvis form U.K. subsidiary

THE well-known Rotterdam company, R. S. Stokvis and Zonen, have formed a British subsidiary named R. S. Stokvis and Sons Ltd., with headquarters at 12-16 High St, Walton-on-Thames (Tel.: Walton 26576). The parent company market a wide range of domestic and industrial goods, including "Erres" washing machines, radio and TV sets, etc., and "Fasto" hot water heaters, and export to all parts of the world through 52 sales offices.

The British firm has set up a domestic appliances division handling agitator and pulsator type washing machines (with or without spin dryers), water heaters, various types of electric fires and stainless steel products. In addition there is the "Interland" tools division to distribute products of W. German Interland GmbH, including hand and power tools, measuring instruments, gardening utensils, etc. Other divisions include a nautical division and a department to promote sales of Stokvis RAP mopeds.

Two instrument firms to merge

TWO instrument firms with world-wide interests are to merge under the terms of an offer made by Cambridge Instrument Co. Ltd. for the whole of the Ordinary share capital of Electronics Instruments Ltd. The offer is on a share exchange basis of seven Cambridge 5s shares for three £1 Electronic Instruments shares. The directors of EI have recommended acceptance of the offer by their shareholders.

Electronic Instruments will continue to operate under its own name with Mr A. C. W. Norman as chairman, Mr P. Goudime as managing director and Mr D. A. Pitman as sales director, joined by three directors of Cambridge Instruments Co. Ltd. If the offer is accepted, Mr Goudime is expected to join the board of Cambridge Instrument Co.

Net assets of EI are estimated at £261,511. The company operates two factories in Richmond and has associated companies in France, Canada and Australia. Personnel employed total 330.

M.I.-Lancs. Dynamo merger complete

THE Metal Industries and Lancashire Dynamo merger has now been completed. MI have acquired the outstanding balances of Ordinary and 5½% Cumulative Preference stock in Lancashire Dynamo Holdings Ltd. for which acceptances were not received from the holders.

Any shareholder who has not received the cash or shares to which he is entitled may receive the same on applying to the company, MI announce, completing the necessary forms of acceptance and transfer and surrendering his Lancashire Dynamo stock certificate, which is now valueless.

Following this transaction and the recent rights issue the issued capital of Metal Industries Ltd. now stands at £10,247,123.

Benjamin Electric in Australia

A NEW company in Australia has been formed jointly by Benjamin Electric Ltd. and Bradley's Electrical Industries Pty, of Sydney. Named Benjamin-Bradley Electric (Pty) Ltd., the firm will manufacture the standard ranges of Benjamin tungsten and mercury lighting fittings, including those for fluorescent bulb lamps and Benjamin floodlights. Offices and works are at 145 Parramatta Rd, Five Dock, Sydney, New South Wales.

New Course for Contracting Apprentices

A NEW three-year electrical installation course intended for entrants to the contracting industry is to be introduced in September by the City and Guilds. Intended to cater for youths aged 15 plus with a lower academic standard, it will lead to the award of the Institute's Electrical Installation Craft Practice Certificate. In this course "A," on the introduction of which the Electrical Contractors' Association have collaborated, the emphasis will be on practical training and knowledge and with only such related studies as are essential to enable a practical electrician to carry out his duties under supervision.

Studies during the first year of the course will provide appropriate preliminary training for entry into the City and Guilds. Course "B" is still regarded as the standard course for journeymen electricians. After the first year, satisfactory apprentices could transfer to the major course.

It is hoped that the new Course "A," which can be for day-release or evening classes, will be available at many local technical colleges this autumn.

Nuclear Safety Committee formed

SIR ALEXANDER FLECK, K.B.E., F.R.S., is to be chairman of a distinguished committee which will advise the Minister of Power and other interested Ministers on all aspects of nuclear safety. The intention to appoint such a committee was announced during Parliamentary debates on the Nuclear Installations (Licensing and Insurance) Act, 1959. The committee has the right to proffer advice on any matters it considers of importance, quite apart from questions which may be referred to it by the Ministers. Membership of the 24-strong committee is noted in our Personalities feature on page 18.

Production gains in April

PRODUCTION in the electrical and engineering goods industries in April, which this year included the Easter holiday, was 6% higher than a year earlier, according to the Board of Trade estimates. Taking March and April together the increase was 13%, about the same as in January and February. The greater part of the increase in the early months of 1960 was of capital goods, while consumer goods generally suffered a downturn in the first quarter.

Other BoT figures show a drop in h.p. sales in May, following April's credit curb. The decrease was 3% on May, 1959 after being 18% higher than last year from Jan. to April. Sales of electrical and radio goods by independent retailers were 6% down, and department stores 5% down, in May compared with April last.

Widecombe to have Electricity

WIDECOMBE-IN-THE-MOOR—of Uncle Tom Cobleigh fame—is to get public electricity supply at long last and only a short section of the lines will go underground. The South Western Electricity Board now hope to make a supply available in 1962, subject to availability of capital, good consumer support and agreement on wayleaves. Announcing this last Thursday, Mr S. F. C. Whitmore, deputy chairman of the board, said the first stage of the scheme would cost £38,000 to supply 180 premises.

The Dartmoor National Park Committee had been very co-operative and a route for the lines had now been agreed, with only a short section underground.

Mr Whitmore was speaking before the civic opening of the board's new service centre at Newton Abbot, in the course of which he pointed out that the board were spending £1,630,000 this year on improving and extending their distribution network in Devon.

. . . and Lynton to have the second automatic substation

LYNTON, beauty spot of North Devon, is to have an automatic unmanned power station in service in September. This will be the second such plant in the West Country—the first was put into operation at Princetown last December, by the South Western Electricity Board. A 3 MW gas-turbine plant, it is intended for emergency use and will be controlled over the public telephone system from the board's area headquarters in Bristol by using robot equipment.

The plant is part of a £140,000 scheme to improve the electricity service to North Devon where, in the sparsely populated area, engineering costs are heavy. At present, Lynton is served by a single 11 kV line. This is being insulated for 33 kV fed in from Barnstaple and involves the placing of a new substation at Lynton.

Shipping Order

EQUIPMENT supplied by Laurence, Scott and Electromotors Ltd. for RMS *Windsor Castle*, the latest addition to the Union Castle fleet, includes 16 Scott cargo winches, two 100 kW auxiliary generators and 18 electric motors, among the largest of which are: three 290 h.p. i.d. fan motors, three 134 h.p. f.d. fan motors, two 170 h.p. electro-hydraulic steering gear motors and one 135 h.p. auxiliary boiler feed pump motor. The winches are of the Scott self-contained type, with magnetic, foot and overspeed brakes.

VICTORY SPECTACLE

ONE of the most unusual "Son et Lumière" spectacles yet produced in Britain was switched on last week at Portsmouth, on Nelson's historic flagship, HMS *Victory*. With a cast including Sir Laurence Olivier as Nelson and Robert Morley, the production follows the history of the *Victory* from prison hulk to flagship.

The special lighting was installed by Atlas Lighting Ltd., using nearly 300 lamps and tubes, some 5,000 yards of cable, with a total load of 65 kW. Since the "Victory," constructed of timber and tarred hemp, is a major fire risk, only a limited number of low wattage lamps could be installed inboard. Most of the floodlighting and ancillary illuminations were installed on the dockside.

The sound equipment, supplied by Standard Telephones and Cables Ltd., comprises a triple amplifier and loudspeaker system operating from three-track stereophonic tape, each of the amplifiers capable of delivering up to 150 W into the loudspeakers.

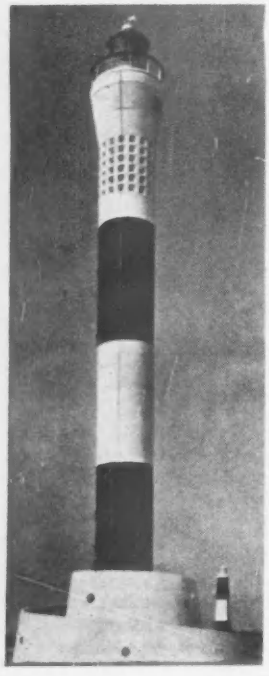
National Park Power Lines Approved

PERMISSION has been granted to the South Wales Electricity Board by the Minister of Power to erect overhead power lines through Pembrokeshire National Park to houses on the St. David's head peninsula, near Whitesands Bay. The board's application was opposed by the county council and the Council for the Preservation of Rural Wales. A public inquiry was held on 27 January last.

Consent has been given to four out of the five lines for which application was made, with minor modifications in two cases. In the case of the remaining line the board are invited by the Minister to apply for consent on a different route. The council opposed the scheme on the grounds that it would be detrimental to the beauty of the park area.

At the inquiry it was contended on the council's behalf that the lines should be placed underground and that the extra cost of some £3,000 should be met by the board as a public body and spread over the board's consumers as a whole. The board held that if underground cables were used instead of overhead lines the scheme would become uneconomic and would have to be postponed or abandoned.

In the letter from the Ministry it was noted that "the board was prepared, in order to lessen the effect of the lines on the amenities, to spend the sum of about £800 over and above the cost of placing the lines on the shortest and cheapest routes."



DUNGENESS AUTOMATIC LIGHTHOUSE

THE first major Trinity House lighthouse tower to be erected for more than 50 years was officially opened at Dungeness last week by the Duke of Gloucester. Built by Taylor Woodrow Construction, the tower is the first of its kind in the country and embodies a number of new structural ideas. Height is 130 ft and the walls are only 6 in. thick within the overall diameter of 12 ft.

Light for the main beam is provided by a lamp of entirely new design, developed by Trinity House engineers in conjunction with the AEI Lamp and Lighting Co. Of the high-pressure xenon discharge type, and little larger than a domestic light bulb, the lamp gives out 600,000 candle power, or three times that of the paraffin light in the former Dungeness lighthouse.

The fog signal, of Trinity House design and incorporating units made by Tannoy, is automatically set in action when warned of the incidence of fog by a special fog detector devised by Trinity House research staff and manufactured by Stone-Chance Ltd. A total of 60 loudspeaker units, positioned behind rows of apertures in the top white band of the lighthouse (see picture at left), form the fog signal.

The lighthouse was constructed in six months, despite interference from bad weather, using the latest prestressed concrete techniques. The spiral ramp at the base of the tower contains all the electrical controls, standby generators and fog-signal equipment.

Glasgow Fire Inquiry

EITHER a fault in an electrical system or a dropped light was responsible for the fire and explosion in a Glasgow whisky warehouse in March, which killed 19 men. This was the opinion of some witnesses at a Fatal Accidents Inquiry held last week. It was said that the warehouse had been completely rewired when taken over three years ago.

A fire prevention officer expressed himself as shocked to find ordinary fluorescent lighting in use in the building, in view of the risk of inflammable vapour, but a police officer who gave evidence later thought it "extremely unlikely" that the fluorescent fittings could have caused the fire.

At the end of the inquiry the jury made a recommendation that an automatic fire alarm system should be installed in all warehouses where alcoholic liquor was stored.

Record Month for Refrigerators

MAY was a record month for both home and export sales of domestic refrigerators, according to DorDec figures issued this week. Home sales of British-made refrigerators totalled 137,279, compared with 125,881 in May, 1959—a 9% increase.

This is claimed to be the highest monthly total ever achieved by the industry and brings the total of home sales for the five months from January to May to 526,829—a figure which exceeds the total sales for the whole of 1958 (in that year they were 448,646).

Export sales increased by 76% compared with May last year, and were higher than in any previous month. DorDec comment that the increasing export figures provide "effective proof of the value of a substantial home market as the basis of a vigorous export drive."

Edmundsons in Exeter

A NEW branch depot with a 79 ft frontage has been opened by Edmundsons Electrical Wholesalers Ltd., at 17-25 Hoopern St, Exeter. For three "open days" following the official opening trade customers from Exeter and other parts of Devon were able to visit the premises and see for themselves the improved warehousing and trade counter facilities available. An electric hoist is used to move goods between the floors.

This new branch has been opened by GEC at Stevenage, Herts, to replace the branch at Luton which has now closed down. With a stores area of 11,500 sq ft and office and showroom area of 3,000 sq ft, the branch will provide improved service over the whole range of GEC products to customers in the area, enabling them to obtain goods immediately via trade counter or van delivery

U.K. exports to U.S.A. "frightening"

"THE figures for trade between Britain and the USA for the month of May are frightening," Lord Rootes, chairman of the Dollar Exports Council, said in London last week on his return from the British Exhibition in New York. "While the exports of the UK to the USA increased by 7·4% during the month, and those to Canada rose by 14·4%, America increased her imports into this country by no less than 95·6% and Canada's increase was 40%. Both countries sold more in this country by far than we sold to them."

Failure to grasp this situation would lead only to disaster, Lord Rootes warned. Liberalisation was a correct policy, but it would place a great burden on the British people for it meant that inflation must be held and costs lowered. All must appreciate the intense competition we were up against from the Continent, Japan and the USA. While we wanted to see all our workers well provided for, there was no room for wage increases unless we improved productivity.

However, the warning on trade figures did not decrease Lord Rootes' enthusiasm for the British Exhibition. "In New York it is being looked on as the best exhibition ever staged by anybody, including the Americans," he said. "They have never seen an exhibition quite like it because it did present modern Britain in a manner we can all be proud of."

The trade fair, he said, had brought many thousands of orders and inquiries. Over 30,000 buyers had registered their names and more than 10,000 people had made inquiries at the joint Dollar Exports Council and Federation of British Industries stand alone. More than 100 genuine inquiries for factory development in the UK were received.

"But," Lord Rootes added, "the success of the fair does not only mean that we have a chance to improve our trade in the dollar areas. With the liberalisation of dollar trade by the Government, it also means that the balance of trade may gradually grow worse unless a more determined effort is made."

What we want is partnership . . .

"WHAT we want is an arrangement and partnership between the two groups (the Six and Seven) for a common system of European trade—and that does imply loyalty to our friends in the European Free Trade Association—and then every possible effort to reach agreement on how the Six and the Seven can be brought into a common European trading system," the Prime Minister said in the House of Commons last week.

He was replying to a question which asked whether the Government had really made up its mind to enter the Common Market if suitable terms could be agreed and arrangements could be made with Britain's partners in the Seven and the Commonwealth.

Mr Woodrow Wyatt (Lab.) wanted to know if Mr Macmillan was aware that the growing strength of the Common Market represented an urgent threat to British industry. Mr Macmillan answered that he would, of course, do anything he could which seemed at the right moment best calculated to lead towards the achievement of the aim of the whole House—a partnership between the two groupings in a common system of European trade consistent with GATT.

. . . not sabotage

THE Government was not seeking to sabotage the Six, or using the Commonwealth as an alibi, the Earl of Home, Commonwealth Relations Secretary, declared in the House of Lords last week during a two-day foreign affairs debate.

"We have no wish for an alibi," he said. "The attitude of the Commonwealth countries is that they want to do everything they can to contribute to the political cohesion of Europe. They are willing to make certain sacrifices, for instance in the preferential system, if it would help the UK to strengthen her economy by coming closer to Europe. But they will want to see the actual proposals first."

The Government was "examining and re-examining" the price Britain would have to pay for joining the Common Market, Lord Home stressed, but at the time of the Commonwealth Prime Ministers' conference they were not able to measure and still could not measure, what that price would be.

E.I.B.A.'s GOOD YEAR

MORE than 1,000 people employed in the various electrical industries received help from the Electrical Industries Benevolent Association last year, an increase of 9% on the previous year, states the annual report of the EIBA presented at their a.g.m. in London today (7 July). In all the total number of people helped, including dependants, was 2,475.

Meter by-pass death

A MAN who tried to restore the electricity supply to his home by by-passing the meter after the supply had been cut-off was electrocuted, it was stated last week at a St. Pancras inquest. The dead man, Dennis Wenn (21), of Hackney, had tried unsuccessfully to borrow money to pay the electricity bill, but eventually the supply was cut off. He was found lying in the cellar with his clothes alight.

Recording a verdict of accidental death, the Coroner said: "This was an obvious attempt to by-pass the meter and restore the supply."

Clean Air and Electricity

MEDIUM-SIZED power stations from about 60 MW upwards present the most difficult problems so far as air pollution from electricity generation is concerned. That is the opinion of the Alkali Inspectorate, expressed in the annual report for 1959, published by HMSO last week. These stations are often stoker fired and are often fitted with grit arresters of what the inspector calls "the less efficient scroll type," and there have been complaints about chimney emissions from some of them.

Tests arranged by the inspectors have shown that in some cases the arresters have been working at less than their full efficiency because of poor maintenance. The CEGB is to give more attention to this point; and, once it is clear that all the arresters are being well maintained, the Alkali inspectors will review the whole problem again—they warn that more elaborate means of flue gas cleaning may be needed in some cases.

So far as small stations used only for peak and emergency operation are concerned, the only remedy for trouble from the clean-air aspect is to close the stations, and this is being carried out at a high rate. With stations of the 1,000 MW class, the clean-air problem is solved at the design stage. The report adds the tribute that "very satisfactory liaison in this matter, as indeed with every other facet of power station emissions, exists between the department and the experts of the CEGB."

On oil-burning power stations, the inspectors say that the main problem is the occasional emission of acid smuts, the reason for which is not known with certainty. Special attention has been given to the problem by the CEGB R and D department and their advice to stations on precautions that can be taken is having a beneficial effect, but some difficulty is met with because control of combustion to give minimum formation of sulphur trioxide involves high CO_2 in the flue gases and comes near the point where emission of dark smoke is unavoidable. Use is also being made of additives to reduce acid smut trouble.

The value of high chimneys in reducing trouble from stack emissions is demonstrated by the case where the Air Ministry insisted on a chimney height of only 120 ft. The result was what the inspectors note as a justified complaint about emissions; now the Air Ministry have agreed to the chimney being extended 45 ft.

Electrician's Claim Dismissed

AN electrician's claim for damages against the Skinningrove Iron Works Co. Ltd. in respect of burns suffered in an accident in 1957 was dismissed in Middlesbrough County Court by Judge Clifford Cohen. The man, Mr R. L. Peel, stated that he was instructed to overhaul a hot saw and after isolating it he slipped on a patch of grease and fell into the transformer cubicle. There was a flash and he received burns; as a result he was off work ten weeks.

Dismissing the claim, the judge referred to two important factors in favour of the firm. As the case gate surrounding the transformer was found to be locked, it was most unlikely that anyone could have locked it in the short time which elapsed. Secondly, within two hours of the accident the works safety officer had inspected the floor of the substation and found no grease.

Mr J. Blackett, chargehand electrician, when questioned, said that Mr Peel told him he had slipped and fallen against a transformer switch.

Computing 1,000 times faster

ELECTRONIC computers which will carry out complex mathematical calculations 1,000 times faster than existing types are now possible, state Elliott Brothers (London) Ltd., who have developed new techniques in their Computer Research Laboratories enabling switching time to be reduced to no more than five millimicroseconds.

The techniques are already being applied in some special purpose machines and, in due course, they will be applied more generally. The company say that the great speed available will enable one computer, with multiple input and output channels and using time sharing, to do the work of a number of conventional computers so that, in terms of work done, the expense of computer time will be reduced from existing levels.

TROUBLE WITH GRIT

WITH the "grit trouble" from Wilford power station much in mind, Nottingham Health Committee have decided to take all measures to oppose the proposal to build another power station twice as big at Holme Pierrepoint with two chimneys each 600 ft high. The committee have recorded their "grave fears" as to the effect of the station on the inhabitants of the city.

Nottingham's Medical Officer of Health, Dr. W. Dodd, said last week that with the existing Wilford station to the south west and the proposed new one to the south east it appeared that there would be grit from one or the other for much of the year as the winds often blew from those directions. "The fact that the chimneys are so high must mean they have a good deal to dispose of," he added.

A committee member commented that the proposed power station would be an eyesore. The committee had been told that the proposed power station would be some 200 ft high with eight 375 ft cooling towers.

3s too big: Appliance firm fined £10

A NEWSPAPER advertisement in which undue prominence was given to "3s," the weekly instalment payable on a washing machine, resulted in a successful Board of Trade prosecution under Section 3 of the Advertisements (Hire Purchase) Act, 1957, in Bow St Magistrates' Court last week.

Vactric Ltd. were fined £10 and ordered to pay £10 10s costs for causing an advertisement to be displayed in *The People* on 7 Feb. last in which it was alleged that the weekly instalment of 3s in respect of the firm's new Vactric WR1 electric washing machine offered for sale by hire purchase or credit sale was given undue prominence by being in large type compared with other details.

All the statutory details, such as deposit, cash price and period of repayment, were included in the advertisement, but the Act required that undue prominence must not be given to any particular detail, it was stated.

The main 24-position, 2,000-line manual telephone exchange at the BBC Television Centre which provides direct communication to all internal numbers, the Lime Grove and Shepherd's Bush studios, Broadcasting House and four GPO telephone exchanges. The central desks are for inquiries, with the supervisor at the left. The equipment, costing over £100,000 including interconnecting cables, was supplied and installed by Standard Telephones and Cables

Progress at Hinkley Point

STAGE-BY-STAGE construction progress on the world's first 500 MW nuclear station at Hinkley Point is depicted in a high quality colour film prepared by the Atomic Power Group: English Electric, Babcock and Wilcox and Taylor Woodrow. At the Press conference held to introduce the film, it was stated that while the first of six generator sets is expected to be running by mid '62, the station will not be completed until mid '63, a year later than the original estimate. Delay has been caused partially by design modifications, but also by labour troubles, responsible for similar delays at the other two nuclear stations under construction for the CEGB at Bradwell and Berkeley.

A clear commentary and animated diagrams in the film show the constructional features of the station and of some equipment which will be installed. It runs for 29 minutes and may be obtained on loan from English Electric Co., Marconi Hse, Strand, W.C.2.

Manchester Electronics Exhibition

A TOTAL of 75 firms are exhibiting at the fifteenth annual Electronics and Instruments Exhibition which opened today (7 July) at the College of Science and Technology, Sackville St, Manchester 1. A convention, running concurrently with the exhibition, includes a comprehensive programme of lectures and film shows. Admission tickets are available free from the organisers, the Institution of Electronics (Northern Division), 78 Shaw Rd, Rochdale, Lancs.

Sayings OF THE WEEK

"The Government should now take more seriously those of us who urge a direct fuel and power policy. If the Minister of Power feels he is technically incapable of carrying through such a policy, then Parliament should be asked to consider the creation of a National Energy Commission to control but not to own primary energy sources." . . . MR A. M. F. PALMER, writing to *The Guardian.*

"On past occasions, Tees-side smells were powerful enough to wake me in the night." . . . ALD H. L. HOGG, of West Hartlepool, commenting on annual report of Chief Alkali Inspector for England and Wales.

"We are producing far too many mediocre scientists. This country wants good scientists and simply cannot afford a tremendous influx of second-raters." . . . DR R. ALLISON, of Ashby de la Zouch Grammar School.

PRICES of cable metals and other materials

Figures quoted are the official prices ruling on Tuesday, July 5

	£ per ton	Weekly change £
COPPER, standard class A (settlement) ...	254	−2½
" (3 months)	244	−1½
LEAD, refined pig, 99·97% purity (cash)	71⅛	+1
" (3 months)	72¼	+⅛
TIN, refined, min. 99·75% purity (settlement)	809	+9
(3 months)	798½	+6
ALUMINIUM, ingots 99·99·5% ...	186	—
wire bars (4 x 4 x 54") ...	193½	—
BRASS Strip 63/37	220½	−3½
SILVER (Troy oz)	79½d	—

	£ per ton	Weekly change £
ZINC virgin, min. 98% purity (cash)	89½	−⅜
" (3 months)	89¼	−⅜
RUBBER, per lb.		
No. 1, R.S.S. spot	34½d	−2½d
c.i.f. basis, ports, Sept.	33½d	−1½d
ARMOURING:		
Galv. Steel Wire (0·104 in.) ...	66½	—
Mild Steel Tape (0·04 x 1½ in.)	53*	—
NICKEL (home)	600	—
MERCURY (76 lb flask)	70½	−½
AMERICAN PRICES:		
Copper, electrolytic (per lb) ...	33c	—
Lead (New York)	12c	—

** Tape Price, now an average, includes varnishing*

Salesman took clock as h.p. deposit

A DOOR-TO-DOOR salesman persuaded an elderly couple to buy a £32 vacuum cleaner which they did not need and could not afford; then, as they had only a shilling in the house and could not pay the deposit of £4 1s, he took their only possession of value—a clock. This was stated by counsel for the police at Old Street Magistrates' Court last week when no evidence was offered against Henry B. J. Beahan (23), a sales supervisor, of Clapton, charged with stealing £4 11s, property of Charles Patten, of Clapton. He was discharged under Section 7 of the Magistrates' Courts Act.

Counsel said that a Mr Smith, formerly employed by National Utilities Ltd., but no longer living in this country, called on Mr and Mrs Patten, both aged 70, and prevailed on them to sign a hire-purchase agreement requiring a deposit of £4 1s and subsequent instalments totalling £36 9s for a £32 vacuum cleaner. As they had only a shilling in the house he took an old fashioned family chiming clock, saying they would get it back when the deposit was paid. Later the couple wrote to the firm saying they did not want the cleaner.

Beahan, another employee of the firm, then called and said they could have the clock back if they paid the deposit plus 10s to cover his expenses for taking the cleaner away. Mr Patten borrowed £2 and obtained a further £2 11s by pawning his wife's ring, paid the money to Beahan and recovered the clock. Later he notified the police.

When interviewed by a detective sergeant, Beahan said: "Let me expain. That is the way we work." He also said that if he had not taken Mr Patten's money, Smith would not have got his commission. The police view was that the offence of larceny by trick had been perpetrated, but after legal consideration the police decided they should not ask the Court to say this transaction was necessarily induced by fraud, and therefore offered no evidence.

Dismissing the case, the Magistrate told Beahan: "I make no comment on the methods you choose to use to carry on your business."

Clough Smith Jubilee

INVOLVED in the early conversion of tramways from rail to overhead power supply, Clough Smith and Co. Ltd. have just celebrated the fiftieth anniversary of the foundation of the company. This is commemorated with an interesting brochure recalling some of the difficulties encountered, long since overcome, and the expansion of activities to all forms of cable erection work in Britain and overseas, including street lighting, industrial installations and floor-warming—they did the cabling and installation job at Kariba. In recent years the firm have also installed o.h. equipment for the BR modernisation scheme. Mr N. Clough and Mr S. G. Smith, originators of the company, have since retired, but the progress continues unabated.

News in Brief

Mersey Cable Works Ltd. was elected a member of the Cable Makers' Association on 1 July, 1960.

Mr G. H. Collins, of Malvern, has made a gift of £2,000 to the EIBA through its Birmingham branch. He made a similar gift five years ago.

More than 200 young engineers from the English Electric Co.'s Rugby works received indentures and merit awards recently. Presentations were made by the chairman, Lord Nelson of Stafford.

The Dresden, USA, nuclear power station (to which we referred on 5 May) reached full power on 30 June.

Two Pitt-Scott (Johnson type) mooring winches ordered for the TEV *Canberra* from Laurence Scott and Electromotors Ltd. will maintain constant tension within the 2,500-15,000 lb range with automatic control, increasing to 20,000 lb in manual control.

L. E. Simmonds Ltd. have secured orders for over 10,000 PO type relays for use at Hinkley Point nuclear power station.

Company Activities

NOW that the dust is settling after Mr Amory's farewell broadsides from the Treasury, Stock Markets seem to be taking a more confident view of the immediate prospect. Nearly each day last week the industrial share index inched its way a little higher so that from the post-Bank Rate trough of 306·3 there was a recovery to 315·2. In the circumstances, this was quite an achievement since the level immediately before the 6% Bank Rate announcement was 314·9. We are therefore back to better than from where we started!

There is little doubt that the Treasury statement on the Balance of Payments for the first three months of 1960—a £46 million surplus against an £18 million deficit in the fourth quarter of 1959—considerably cheered sentiment although it is perhaps surprising that even this was not treated with more reserve. Compared with the first quarter of 1959, the Treasury's figures indicate that imports were up by about 12% but that exports were better by nearly 16%. On the other hand, the Board of Trade's Trade and Navigation Accounts, which record the value of physical movement (in contrast to actual payments) of imports and exports through the ports, show that in the first quarter of 1960 exports were up 16% on the first three months of 1959 but that imports were 20% higher! So, in effect, the Treasury says exports were running 25% higher in this period and the Board of Trade says it was exactly the other way round!

In the light of the intensified "credit squeeze," which has as its special purpose the easement of our export-import imbalance, it would certainly appear that the Chancellor has attached greater importance to the trend shown by Mr Maudling's department rather than his own! For this reason, markets could have been expected to have turned easier. That they have done the reverse rather suggests that the Chancellor's latest stitches in time will stave off any anticipated crisis this autumn.

Over the week, electrical companies, which have such an important role to play in this export-import battle, saw very little change in their share prices. AEI dropped 6d to 52s 6d, GEC shed 4½d to 35s, but English Electric gained a good 2s 6d to 38s 6d, no doubt helped by their £500,000 order for electrical equipment for a new 148 in. four-high hot-aluminium rolling mill. In the consumer durable goods market we had Vactric 9d lower at 24s to compared with a 1960 "high" of 43s 9d and Hoover "A" 1s 1½d firmer at 40s 7½d against this year's peak price of 54s 6d. Both these shares—credit squeezes pass as well as arrive—look decidedly attractive investment propositions. Last year Vactric's dividend was 2·9 times covered and the shares now yield 7·8% while Hoover could have met its dividend 3·9 times out of earnings and now return £5 10s%.

Elsewhere, we had the 17% spurt in the price of electrical Pye to 16s 9d, both on the results which showed profits after depreciation but before tax up by over 40% and indications of expansion plans.—*From our City Correspondent.*

Aron Electricity Meter Ltd.

Trading conditions have in no way become easier during the past 12 months, but as a result of timely and effective actions, this company has been able to trade on level terms against the fiercest competition in the electricity meter business, Mr E. D. A. Herbert, chairman, reports. In the home market, turnover has been increased and similarly on the overseas market where the profit on this business is generally very slender. But new products are being developed which necessitate the provision of expensive new plant. The board is convinced these will provide a handsome return in the future and, looking ahead, an alternative factory site is being sought. The name of the company is to be changed to Aron Meters Ltd.

E. K. Cole Ltd.

Although the group profit for the year to 31 March is slightly down at £817,478, dividend is raised by 2½% to 22½% for the year on capital as increased by a one-for-three rights issue, with a final of 15%. In the previous year, with a profit of £817,773, dividend was 20%. After taxation, net profit is £417,928 (*£403,873*).

Colvern Ltd.

This electronic component firm is raising its final dividend 7½% to 25%, making 35% for the year to 31 March last. Profit for the year rose to £221,615 (*£164,646*).

Drake and Gorham Ltd.

An increase in group trading profit is reported for the year to 31 March last. The total is £129,476, against £94,856 for the previous year. Dividend is also raised 7½% to 17½%.

Johnson Matthey and Co. Ltd.

For the year to 31 March, group profit is £1,925,299 (*£1,455,909*), and a final dividend of 9% maintains the total distribution at 12% on capital increased by a 50% scrip issue.

Marryat and Scott Holdings

Group net profit for the year to 31 March is £110,295 (*£103,210*) after tax, and the dividend is raised 5% to 27½%.

Pyrotenax Ltd.

With the group trading profit for the year ended 31 March last increasing to £808,133 (against £740,276 for the previous year), the dividend is raised by 6% to a total of 40%, with a final of 25%. After taxation charge of £425,955 (*£400,306*) the net profit is £430,894 (*£391,750*).

Reliance-Clifton Cables and Industrial Products Ltd.

The worst of the storm in the cable industry has probably been weathered, in the view of Sir Robert Renwick, the chairman. He told shareholders at the meeting last week that the board would be watching the situation very closely in the next few months and if there was confirmation of that view they would not think it necessary to further defer the increase in dividend, which in less abnormal circumstances would have been recommended that day.

Richardsons, Westgarth and Co.

A warning that in view of an inevitable fall in profits a reduction in dividend must be regarded as likely has been given by Mr O. J. Philipson, the chairman. His expectation of lower profits is based on the present trend of costs and the low level of prices. On the basis of orders on hand, the works' degree of activity in the current year will probably be somewhat greater than in 1959-60. At 31 March last the value of main contracts on the books was £35 million, slightly more than at the beginning of the year.

Simms Motor Units

It has been decided to issue 1,737,224 Ordinary 5s shares at 10s on a one-for-five basis. The net proceeds—£850,000—will cover the cost of the acquisition of Dawe Instruments Ltd. and its subsidiary, LMK Manufacturing Co. and meet heavy expenditure for new plant at Simms, the building of a new factory at Bath for Horstmann Ltd. and finance expanding production programmes of other group companies, Mr G. E. Liardet, the chairman, told shareholders last Friday. He also added that the group's trading operations in the current year to date are satisfactory and, if the present favourable conditions continue, it is intended to pay 15% dividend on the increased capital.

Ward and Goldstone Ltd.

Profitability, in certain sections of the Cable Division, has been sorely impaired by the debasement of selling prices, consequent upon the incomprehensible practices of certain leading manufacturers, "who have either deliberately, or by lack of knowledge, set a price standard below the cost of production," Mr Sampson Goldstone, the chairman, reports. "Such arrant folly is dangerously detrimental to all facets of the industry and while there is, at least, some evidence of a change, its injurious effects will, unfortunately, remain for some time," he says. He is also concerned at imports of cheap accessories (see page 29) but otherwise is confident of the development of the Group which now operates 12 factories in Lancashire alone, the latest, of 350,000 sq ft floor space, being expected to be in operation early next year.

COMMERCIAL INFORMATION

Contracts Open at Home . . .

Dates given are the final for receipt of tenders unless otherwise stated.

7 July—E. Riding C.C. Installation of electrical services at new Melbourne County Primary School. County Architect, County Hall, Beverley.

7 July—Hastings C.B. Electrical installation in St. Paul's Primary School, Horntye Rd, St. Leonards.—Advertised 23 June issue.

8 July—Bridlington. Electrical installation in Manor Convalescent Home, 60 South Marine Drive.—See 30 June issue.

8 July—Brighton. First stage: Electrical installation on fixed-price basis in Brighton, Hove and Sussex Grammar School for Joint Education Committee.—See 23 June issue.

8 July—Darlington R.D.C. Supply and erection complete of three recirculation pump sets with electric motors automatically controlled, two of 1,200 g.p.m. each at a 28 ft head and one of 100 g.p.m. against a 20 ft head.—See 16 June issue.

8 July—Co. Derry. Electrical installation in new voluntary secondary intermediate school for Rev. P. Dillon.—See 16 June issue.

8 July—Edinburgh T.C. Electrical installation in Parsons Green Primary School. Applications to City Architect, City Chmbrs, by above date.

8 July—Lichfield C.C. Supply, erection and installation of 27 steel columns with sodium lanterns and ancillary equipment.—Advertised 23 June issue.

8 July—Worksop B.C. Installation of fluorescent lighting in parts of Museum and Public Library. Applications to Librarian and Curator, Public Library, Worksop, by above date.

9 July—Bridgwater B.C. Supply and erection of 200 sodium and mercury/fluorescent lamps on 15 ft prestressed concrete columns plus the conversion of 50 tungsten units to mercury/fluorescent; contract includes the supply and jointing of underground cables. —See 2 June issue.

11 July—Bury C.B. Electrical installation at the School of Arts and Crafts. Borough Engineer, Town Hall. Deposit £2.

11 July—Coseley U.D.C. Erection of 195 Group "B" lighting units on concrete columns with the probability of a further 39 Group "B" and 20 Group "A" units.—See 23 June issue.

11 July—Hereford T.C. Wiring installations in 105 houses on Redhill estate, section four; 62 houses on Newton Farm estate, section four; 102 houses and 10 bungalows on Redhill estate, section five.—Advertised 30 June issue.

11 July—Lancs C.C. Electrical installation at Ormskirk Edge Hill Training Centre. Applications to County Architect, P.O. Box 26, County Hall, Preston, by above date, quoting reference A/G.

11 July—Maidstone B.C. Provision and electrical installation of water heaters at Elizabeth Close flats. Borough Engineer, Palace Ave.

11 July—New Mills U.D.C. Erection of 11 street lighting points included in roadworks in Bakehurst estate extensions.—See 30 June issue.

11 July—N. Ireland Hospitals Authority. (3) Electrical engineering services in erection of new boilerhouse at Downshire Hospital, Downpatrick. Secretary, N.I. Hospitals Authority, 27 Adelaide St, Belfast. Applications by above date.

11 July—West Riding C.C. Supply and erection of eight 200 W sodium vapour lighting on steel columns complete with lanterns, lamps and gear for A630/Doncaster By Pass Motorway junction at Warmsworth. —See 30 June issue.

12 July—Leicester C.C. Electrical installation in old people's home, Narborough Rd. City Architect, I. H. Lloyd Owen, 10 Loseby La.

12 July—Ormskirk U.D.C. Provision of additional power points plus renewal of switchgear and lighting circuits in 77 houses. —Advertised 23 June issue.

12 July—Queensbury and Shelf U.D.C. Separate trade tender electrical work in erection of a pavilion, Shelf Hall Pk.—See 16 June issue.

12 July—Southport C.B. (1) Electrical installation sub-contract in proposed Occupation and Industrial Centre, Sandbrook Rd, Ainsdale.—See 9 June issue.

13 July—Durham C.C. Electrical installations in: Washington Grammar Technical School kitchen and dining room extensions and in seven smallholdings. Applications to County Architect, South St, Durham, by above date.

13 July—Hertford B.C. Applications invited for inclusion in select list of contractors for erection, columns, lanterns and equipment for (a) 300 400 W mercury fluorescent units; (b) 268 200 and 140 W sodium units; (c) 203 60 W sodium units; and (d) 338 100 W tungsten units on existing gas columns.—Advertised 23 June issue.

14 July—Beverley R.D.C. Contract Two. Supply and erection of three 300 cubic ft per min. unscreened sewage pumps complete with motors, starters and accessories. —See 30 June issue.

14 July—Sunderland C.B. Electrical installations: in 138 dwellings; in Plains Farm Junior School for water heating services; in Bede Grammar School's kitchen dining room block.—See 30 June issue.

14 July—Sunderland T.C. Electrical installation in £16,000 community centre at Monkwearmouth.—See 23 June issue.

15 July—Callander T.C. Supply, erection and putting into service of 10 steel columns with 140 W sodium lanterns and auxiliary equipment for A81 lighting.—See 23 June issue.

15 July—Croydon C.B. Electrical installation in Whitehorse Manor School, Whitehorse Rd.—See 30 June issue.

15 July—Kesteven C.C. Supply and erection of 15 steel lighting columns at A1 Gonerby Moor roundabout.—See 30 June issue.

16 July—Rayleigh U.D.C. Supply and erection of 74 Group "B" concrete columns with metal filament lamps, etc. Engineer and Surveyor, Council Offices.

18 July—Irwell Valley Water Board. Supply and erection of automatic electric pumping plant, Whitfield, to deal with constant 2 m.g.d. flow.—See 2 June issue.

18 July—Morley B.C. Supply, installation and putting into service of 36 totally enclosed 140 W sodium street lighting units on 25 ft concrete columns.—Advertised 30 June issue.

18 July—Scalby U.D.C. (a) Supply and erection of 34 colour corrected m.v. 125 W lamps and 11 80 W for Group "B" lighting; (b) supply of lanterns, time switches, lamps and ancillary equipment; (c) supply, erection and painting of 15 and 18 ft steel columns complete with brackets; (d) installation and wiring (b) equipment, for Coldyhill Lane, Newlands Pk Drive, Cleveland Ave and Weydale Ave. Newby lighting. —See 30 June issue.

20 July—Swansea C.B. Electrical installation included in improvements at Hendre Fawr Hse, Garnswllt, Ammanford. Water Engineer and Manager, The Guildhall. Deposit £1.

21 July—N.I. Hsg. Trust. Electrical installations in 108 dwellings at Banbridge. Trust Offices, 12 Hope St, Belfast.

22 July—Mildenhall R.D.C. Contract 2. Supply and erection of two each of 450, 600 and 125 g.p.m. crude screened sewage pumps and two 100 g.p.m. sludge and supernatant water pumps, all complete with motors, starters and accessories. Details from consulting engineers, John H. Haiste and Partners, Belmont Hse, 20 Wood La, Headingley, Leeds 6. Deposit £3 3s, payable to R.D.C.

22 July—Reading C.B. Supply and installation of cables, switchgear, fittings and accessories for distribution, control and site lighting for new Manor Farm Sewage Disposal Works, which is under construction. —See 9 June issue.

22 July—Twickenham B.C. Supply of: (a) reinforced concrete and (b) steel columns and brackets; (c) supply and erection of lanterns/control gear and erection of columns/brackets for 600 sodium and 3 x 80 fluorescent lighting units, being Stage IV of street lighting improvements. Borough Engineer and Surveyor's Office, York Hse. Deposit £2 2s.

25 July.—E.B. for N. Ireland. Supply and erection of power, control and indication cables for boiler/turbo-generator No. 3 at Coolkeeragh Power Station. Details from consulting engineers, Kennedy and Donkin, 64 Royal Exchange, Manchester 2. Deposit £5 5s.

25 July—Forehoe and Henstead R.D.C. (c)

Your Queries Answered

Readers are invited to make use of our free enquiry department which possesses wide resources, including an index of trade information with over 100,000 entries

A Selection from the 106 queries answered this week

"Bunnie" incinerators — makers of? Y.E.B.—Wandsworth Electrical Mnfg. Co. Ltd., Portman Chmbrs, 7-9 Baker St, W.1.

"Centec" grinders—makers of? T.E.—Central Tool and Equipment Co. Ltd., Maryland Ave, Hemel Hempstead, Herts.

"Dix" battery cut-outs — makers of? L.E.B.—Leslie Dixon and Co., 214 Queenstown Rd, S.W.8.

"Copperweld" earthing rods—suppliers of? M.M.—The Stemet Earthing Co. Ltd., 17 Northburgh St, Clerkenwell, E.C.1.

"Sinex" vibrators—makers of? D.M.—Sinex Engineering Co. Ltd., Central Way, North Feltham Trading Estate, Feltham, Middx.

"Bairn" paint strippers—makers of? E.D.A.—Osborn Mnfg. Co. Ltd., 5-13 Highgate Sq, Birmingham 12.

"Junction" irons—address for? L.E.B. —G. P. Chamberlain and Co. Ltd., Carmichael Rd, S.E.25.

"Elstein" infra red equipment—suppliers of? P.I.—P. and R. Electrical Co. (London) Ltd., Pearl Hse, 1 Berrymead Gdns, W.3.

"Landers" waffle irons—address for? S.E.E.B.—L. G. Hawkins and Co. Ltd., 30-35 Drury La, W.C.2.

Electrical installation in Central Depot, Ketteringham.—See 23 June issue.

25 July—Londonderry. Supply of (Item 15) electrical materials for six months from 1 Oct., 1960. Group Secretary, N.W. Hospital Management Committee, Altnagelvin Hospital, Londonderry.

25 July—Wanstead and Woodford B.C. Provision and erection of colour corrected mercury street lighting in Snakes La East (Group "A"), Snakes La West (Group "B") and The Broadway (Group "B"), plus taking down existing gas columns. Borough Engineer, Municipal Offices, E.18. Deposit £2.—Advertised in this issue.

26 July—Ilford B.C. (a) Erection and connection of 1,000 columns; (b) cable laying, jointing and trenching; (c) thrust boring for Stage III of Group "B" street lighting. —Advertised 23 June issue.

27 July—Penybont R.D.C. Provision and erection of 72 100 W tungsten lamps on 15 ft columns on nine sites. Surveyor and Engineer, Coity Rd, Bridgend, Glam. Deposit £2 2s.

28 July—Omagh. Electrical installation in new Crown Bldg, Mountjoy Rd, for M. of Finance.—See 30 June issue.

29 July—Brighton C.B. Supply, erection and maintenance of three electrically driven submersible well pumps and four booster pumps with control gear, etc.—See 16 June issue.

30 July—Bridport B.C. Supply and erection of 26 Stewarts and Lloyds tubular steel fluted columns and 125 W m.v. lamps for Group "B" lighting at North Allington. —See 30 June issue.

12 Aug.—Larne B.C. Electrical installations in: (a) shops and flats at Antiville; (b) 7/4 scheme of 50 dwellings; (c) 75 scheme for 52 dwellings. Council Hsg Consultant, T. J. M. Davison, 47 Station Rd, Larne.

13 Sept.—Cardiff C.C. Supply and erection of pumps, motors, switchgear, screens and other electrical and mechanical plant for complete pumping stations at Usk and Pontypool, contract B.2 of Llandegfedd scheme.—See 16 June issue.

No date stated—Ayr C.C. (1) Supply of concrete columns; (2) supply of electrical equipment; (3) erection; (4) supply of lanterns for 140 W SO/H lamps for Ballantrae A77 street lighting.—See 16 June issue.

No date stated—Berks C.C. Supply and erection of 28 35 ft steel columns, lanterns and other work for Oxford Southern and Western By-pass scheme, Botley and Woodstock Rd roundabouts.—Advertised 30 June issue.

No date stated—Fishguard and Goodwick U.D.C. Provision, erection and wiring of 19 140 W sodium lanterns on 25 ft steel columns and 33 brackets on existing wooden poles for A40 street lighting.—See 23 June issue.

No date stated—Scotland. Supply of 1-200 kW 440 volt motor-driven induction heating generator, complete with condenser cubicle and all associated switchgear.—See 2 June issue.

No date stated—Taf Fecham Water Supply Board. Conversion to a.c. of treatment works at Pontsticill, near Merthyr Tydfil. —Advertised 16 June issue.

CONTRACTS PLACED

Croydon T.C. Electrical control panel for Stroud Green Pumping Station on firm-price basis, Dewhurst and Partner Ltd., £3,977.

E. Anglian Hospital Board. Supply and installation of lift at St. Audrey's Hospital, Melton, Evans Lifts Ltd., £2,330. Recommended.

Hebburn-on-Tyne U.D.C. Electrical installations in Station Rd four-storey maisonnettes, Norman Robinson, £1,740.

Lambeth B.C. Erection of 116 Group "A" steel columns, lanterns and gear plus removal of 70 redundant columns, Abacus Eng. Ltd.

London C.C. Supply and installation of 494 water heaters, F. J. Baynes and Co. Ltd., £27,617 0s 6d.

N. Ireland. Electrical installations in cottages at Baronscourt Forestry Centre, Co. Tyrone, L. S. Hughes.

Northumberland C.C. Cable renewal and lighting alterations at Bellingham School Camp, W. M. Walker and Son, £440 10s and £607; lighting installation, Coxlodge Youth Centre, Bonham Electrical Co., £319; electrical work at Dinnington Village School, J. and A. Oliver, £764; electrical installation at Westmoor George Stephenson Grammar School, F. Reid Ferens and Co., £461. Recommended.

Poplar B.C. Electrical installations: Blocks C, F and G, Alfred St, Iverson Electrical Ltd., £2,992; Sutherland Rd Baths, L. Power and Son Ltd., £3,748.

Stamford. Supply and erection of 32 Group "A" steel columns with 400 W mercury lanterns for M. of Transport, Abacus Eng. Ltd.

Tynemouth T.C. Electrical work at Tynemouth High School, Percy Main Infant School and St. Joseph's School, Northern Electrical Rewinds, £424, £149 10s and £241 10s, respectively.

. . . and Overseas

Details of items marked • may be obtained on application to the Board of Trade, Lacon Hse, Theobalds Rd, W.C.1, quoting reference.

12 July—India. (1) Cables including p.v.c. and m.i.c.c.; (2) f.l.p. busbar chambers, isolators, switchfuses and motor push-button control stations; (3) f.l.p. lighting fittings and accessories; (4) conduit and accessories; (5) fire detection and alarm equipment; (6) tubular steel street lighting columns; (7) earthing and lightning protection equipment; (8) adjustable steel racking. Specifications EL/2 to 9 for Oil India Pipeline Project. Applications to Burmah Oil Co. (Pipe Lines) Ltd., Britannic Hse, Finsbury Circus, E.C.2, by above date.

19 July—India. Three miles of 800 pairs armoured cable. Director-General of Supplies and Disposals, Shahjahan Rd, New Delhi. B.o.T. (ESB/16665/60).•

20 July—India. 25 kV insulators for railway electrification. Deputy Controller of Stores, Calcutta. B.o.T. (ESB/16572/60).•

20 July—Sudan. 1,100 street lighting fittings. Office of Controller of Stores, Central Electricity and Water Administration, Khartoum. B.o.T. (ESB/16698/60).•

26 July—India. 66 and 33 kV transformers for Jaldhaka H.E. Project. Specification Jal-T/1 can be collected from Chief Engineer, West Bengal State Electricity Board, 1 Hastings St, Calcutta 1, on payment of Rs. 30.

27 July—Rhodesia and Nyasaland. O/h travelling cranes. Secretary, Railways Tender Board, Box 1577, Bulawayo. B.o.T. (ESB/16657/60).•

12 Aug.—New Zealand. 19 items of p.v.c. and paper insulated cable. Town Clerk's Office, P.O. Box 803, Dunedin C.1. B.o.T. (ESB/16642/60).•

25 Aug.—Thailand. 230 kV transmission line from Bangkok to Bhumiphol H.E. Plant. Roval Irrigation Dept., Bangkok. B.o.T. (ESB/16668/60).•

2 Dec.—Australia. Specification and tender M.112: eight 130,000 b.h.p. Francis water turbines/accessories. Specification and tender E.510: eight 95 MW generators/accessories for Murray 1 Power Station. Documents from Snowy Mountains H.E. Authority, Stores and Supply Division, Polo Flat, Cooma, N.S.W., fee £A2 each contract. (Practices restricting free competitive tendering may result in rejection.)

TRADE MARKS

This information is extracted from the Official Journal by permission of the Controller.

A.E.I. in oval. 785,593. Class 17. Insulators and insulating materials. Associated Electrical Industries Ltd., 33 Grosvenor Pl, S.W.1.

Culinator. 808,972. Class 7. Food mixing machines. Special Electrical Appliances (1959) Ltd., 108 Leith Walk, Edinburgh.

Diotron. 795,152. Class 7. Machines for use in the manufacture of lamps, valves, etc. M. M. Fox, Triumph Hse, 189 Regent St, W.1.

E.A.R. in design. B797,617. Class 9. Sound recording reproducing apparatus, etc. Electric Audio Reproducers Ltd., The Square, Isleworth, Middx.

Electroscandi. 788,974. Class 7. Motors, etc. 788,975. Class 9. Switchgear, etc. 788,976. Class 11. Lighting apparatus. Aktiebolaget Elektroskandia, 75-77 Norra Stationsgatan, Stockholm, Sweden.

Perspex in design. 795,033. Class 11. Lighting apparatus, etc. Imperial Chemical Industries Ltd., Imperial Chemical Hse, Millbank, S.W.1.

Redifonic. 800,463. Class 9. Apparatus, etc. Redifon Ltd., Carlton Hse, Lower Regent St, S.W.1.

Speedylec. 790,687. Class 11. Steam boilers, etc. Bastian and Allen Ltd., Ferndale Terr, Harrow, Middx.

Transfilter. B791,288. Class 9. Electronic filtering devices. Brush Crystal Co. Ltd., Shipyard Estate, Shore Rd, Hythe, Southampton.

TRADE NOTES

Changes of Address. Oryx Electrical Laboratories Ltd. have moved to Industrial Estate, Meadow Rd, Worthing. Telephone: Worthing 30066.

As from 11 July, Venesta Foils Ltd. are moving to Thorn Hse, Upper St. Martin's La, W.C.2. Telephone: Temple Bar 4399.

As from 29 July, the G.E.C. Applied Electronics Laboratories at Brown's La, Coventry, will be transferred to Portsmouth. The address will be The Airport, Portsmouth. Telephone No.: 62271.

The Publicity Dept. of Dewhurst and Partner Ltd. is now at Midland Bank Chmbrs, 1 York St, Twickenham. Telephone: Popesgrove 9953.

Agency. Limit Engineering Group Ltd. have been appointed sole U.K. agents for inherent self-regulating alternators made by A. van Kaick, of Frankfurt. These are available for outputs of up to 500 kVA.

Expansion. Gent and Co. Ltd. are to build a new subsidiary factory on a site at New Rd, Kibworth, Leics.

New Branch. Santon (Wholesale) Ltd. have this week opened a new branch at 11 Womanby St, Cardiff. Mr H. C. Bowles is the branch manager and Mr R. Franklin is representative.

Furnaces. Agreement has been reached between Wellman Smith Owen (Furnaces) Ltd., and Leone Tagliaferri A-G Milan, whereby W.S.O. (Furnaces) are now able to offer exclusively in the United Kingdom electric arc melting furnaces and ferro alloy furnaces of the Tagliaferri design.

BUSINESS PROSPECTS

Aberdeen. Scottish Agricultural Industries, 34 Albyn Pl, plan £1 million reconstruction of Sandilands chemical works.

Armagh U.D.C. Tender: 86 Drumarg dwellings and five garages, Surveyor.

Belfast. White, Tomkins and Courage, 102 Corporation St, plan £100,000 rebuilding, etc., of their premises.

Bexhill-on-Sea. Wilton Securities Ltd. plan four-storey Fairmont Rd flat blocks.

Bingley. Geo. Luscombe (Builders), Birch Close, Pollard Ave, Eldwick, plan 58 Slenningford Rd houses.

Birmingham T.C. Tender: Nine two-storey Billesley Rd dwellings, Architect.

Blaydon U.D.C. 160 dwellings planned.

Bolton. T. W. Thomson plan 52 houses, Ainsworth La, etc.—A. D. Primrose, 556 Halliwell Rd, 19 Dobson Rd bungalows. —The Walmsley (Bury) Group, Atlas Works, Bury, plan Union Rd foundry.

Bootle. C. Williams and Sutcliffe, 24 Dale St, Liverpool, architects for 64 houses, Stand Park Ave, etc., T. Wright and Sons.

Bournemouth. Nine-storey block 96 flats, Parsonage Rd, for Taylor Woodrow Group, Western Ave, W.5.—Nine-storey block 45 flats planned for Exgourne Properties Ltd. —Eight-storey block 64 flats, Southbourne Rd, for Gregory Developments Ltd.—C. Higgs plans nine-storey block 72 flats, "Old Well House," Sandbourne Rd.—Jackson and Greenen, Hinton Bldgs, Hinton Rd, architects for 13-storey block 352 flats on Burlington Hotel site.

Brighouse. Thornhill Yorkshire Estate Co., 1 Princes St, Huddersfield, plan Delf Hill housing development.

Brighton. R. Green Properties Ltd. plan 16 flats, Upper Rock Gdns.—Evergreen (Investments) plan 56 Bristol Gdns houses. —Gotch and Ptnrs, 26 Regency Sq, architects for 66 Cliveden, London Rd, flats.— T. W. Barnes and Co., 4 Chapel St, plan Boston St factory.

Bury. Wm. Leech (Builders) Ltd., Brandlesham Rd East, plan 126 houses, etc.

Cardiff. B.B.C., Portland Pl, W.1, plan Welsh headquarters, Cardiff Castle Walls.

Carlisle. Cartner and Son, Knowe Terr, contractors for grammar school additions.

Cheadle. Axon and Brown (Etruria), 13 Salem St, Etruria, Stoke-on-Trent, plan 86 houses, Valley Rd estate.

Chester. Liverpool Hospital Board, Castle St, Liverpool, plan base hospital.—Reynolds and Scott, 9 Albert Sq, Manchester, architects for St. Bede's School extensions.

Chester-le-Street. A. and M. Ptnrs Ltd., Oxclose Rd, Washington, plan Fatfield housing development.

Crook and Willington U.D.C. Tender: 50 Sunnybrow Village houses. Architects: T. A. Page, Son and Hill, 75 King St, South Shields.

Cumberland. John Twiname, Allerdale Hse, Brigham, Cockermouth, plan 160 houses, Brandaw, Aspatria.

Darlington. Whessoe Ltd. plan Brinkburn Rd welding shop.—E. G. Crofts, 49 Grange Rd, architect for C. H. Pugh Ltd. factory. —Newcastle Hospital Board plan outpatients' dept. and laboratory, Memorial Hospital. Board's own architect.

Darwen. I.C.I. Plastics plan £500,000 modernisation.

Doncaster. H. A. Hickson and Son, 51 Hallgate, architects for £140,000 YMCA centre, Wood St.

Dundee. Holland & Hannen and Cubitts (Scotland), 5 Royal Terr, Edinburgh, contractors for £500,000 National Cash Register Co.'s extensions.

Easington R.D.C. 75 King's Rd houses planned. Surveyor.

Edenbridge. Frank Bilton (London), Beckenham, Kent, contractors for £72,185 LCC factory on industrial site.

Edinburgh. James Miller and Ptnrs, 18 George St, plan £122,500 Pentland View house scheme.

Essex. Frederick S. Snow and Ptnrs, Ross Hse, 144 Suffold St, S.E.1, consulting engineers for £4¼ million Thames Board Mills, Purfleet, extensions.

Farnham. Heath and Wilshire, Union Rd, plan six-storey flat/shop block, South St.

Felling. Wm. Leech, St. James St, Newcastle, contractors for 10 three-storey Grange Farm houses.

Feltham. J. Laing and Son, Mill Hill, N.W.7, contractors for Champion Sparking Plug Co.'s proposed extensions.

Gillingham B.C. Tender: 39 Britton St dwellings. Engineer.

Glasgow. Lt-Col C. N. Brown, 12 Renfield St, C.2, architect for £100,000 Rutherglen hotel.—Mactaggart and Mickel, 107 West Regent St, plan six six-storey blocks and four three-storey blocks, Gt. Western Rd.

Gloucester. Robert Hitchins, Barnwood Lodge, Barnwood, plan 215 dwellings, Tufley: 40 houses, Churchdown; 22 bungalows, Gartage Hall; 35 houses, Barnwood Lodge estate, Gloucester; 56 bungalows, Bishops Cleeve.

Grantham. H. C. Janes, 189 High Town, Luton, plan 109 Dysart Rd dwellings.

Hadleigh. Gurteen and Sons, Chauntry Mills, Haverhill, Suffolk, plan Bradfield Yard sewing factory.

Hartlepool T.C. 48 Millbank Cres houses planned, Engineer.

Hayes. R. C. Watson and Co., Watford Row, Harrow, contractors for £25,000 Powell Duffryn Carbon Products extensions.

Helensburgh. W. B. Gardner Henderson, Rose Hall, Campbell St, plans £180,000 flats.

Hemel Hempstead. E. J. Robinson, 191 Praed St, W.2, contractors for eight factories costing £100,000 for Development Corpn.

Hertford. Hubert C. Leach, 131 High St, Cheshunt, Waltham Cross, plan 195 dwellings, 65 bungalows, Bengeo.

Hexham. J. H. Newman and Son, Eastgate, contractors for W. Robb's Fore St stores.

Hornchurch. N.E. Metropolitan Hospital Board plan 20-bed maternity unit, St. Georges.

Ilford. W. Ironman, 22a Bertner Rd, Hornchurch, plan four five-storey flats, Station Parade.

Kettering. Drury Estates, 92 London Rd, plan 150 houses, Spinneys Estate; 100 houses, Rockingham Rd.

Leeds. £17 million development plan for University planned. Architects: Chamberlin, Powell and Son, 15 Ave Studios, Sydney Mews, London S.W.3.

Lincs. Sheffield Hospital Board plan dining and day rooms, Rauceby Hospital.

Liskeard B.C. Tender: 15 Lake La houses and garages. Architect: G. R. Vaughan Ellis, Trehawke Hse, Liskeard.

London. Saxon, Snell and Phillips, 9 Bentinck St, W.1, architects for £300,000 rebuilding, etc., Lewisham Hospital.—S. Loweth, 2 Balfour Ct, Sandgate Rd, Folkestone, architect for £40,000 Parmiters Foundation School science block.—LCC plans £371,520 extensions to Daneford Secondary School, Bethnal Green: architects: Edward Armstrong and Frederick McManus, 28 Gloucester Pl, W.C.1.—Unit Construction Co., Faggs Rd, Feltham, Middx, contractors for Parcar Ltd. £350,000 car park/office block, Shoe La.—Richardson and Houfe, 24 Queen Anne St, W.1, architects for 78 Bryanston Sq flats.—The Design Group, Suite 10, 1-11 Hay Hill, W.1, architects for 100 Priory La flats.—Talbot and Co., 314 High Rd, N.15, plan 12 flats, Green La, Stoke Newington.—Ord, Carmell and Kritzler, 27 Stamford Hill, N.16, plan four-storey flats, Lordship Rd.—Leslie A. Keats and Ptnrs, 14 Fitzroy St, W.1, quantity surveyors for 64 Fitzroy St flats.

Luton. Howell and Brooks, 4 Queen Victoria St, E.C.4, architects for £500,000 six-storey office/shops block.

Maidstone. Tender: £400,000, A. E. Reed Group, Aylesford research centre, Larkfield. —Amalfi Properties Ltd. plan estate development at 106 Sandling La.—Cox Bros., 27 Mote Rd, plan 36 Allington Way houses.

Mansfield. Geo. Wimpey and Co., Hammersmith Grove, W.6, plan 82 Oak Tree La houses.

Monmouthshire C.C. Tender: Caerleon Training College extensions. Architect.

Northumberland C.C. Wm. Hall Ltd., Derwentwater Rd, Gateshead, contractors for £259,620 Newbiggin Hall schools.

Northwich. T. P. Lea plan 95-acre housing development, Leftwich Grange Farm.

N. Riding C.C. Tender: Alterations, etc., Scarborough Training College, Architect.

Penarth. Davies, Middleston and Davies, Phoenix Wks, Caerphilly Rd, Cardiff, plan £1 million Cogan Brickworks site flats.

Port Talbot B.C. Tender: 36 Fairfield dwellings. Engineer.

Portslade. J. Longley and Co., Crawley, contractors for £210,000 Metal Box Co. extensions.

Redcar. Corpn. Town Improvement and Water Comm. approve 491 houses. Borough Engineer.

Romford. J. W. Hammond, Lloyds Bank Chmbrs, Main Rd, Gidea Pk, architect for Anglo Cutting Tool Co. extensions.

Rotherham, Steel, Peech and Tozer plan £245,00 training centre.

Runcorn. Broadbridge Bros., Kingsley Cres, plan 44 Coronation Rd houses.— Highfield Tanning Co. plan Moughland La service station.

Scunthorpe. Scottish Agricultural Industries, Basic Slag Works, plan £500,000 works on three-acre site.

S. Shields. J. H. Morton and Son, Martins Bank Chmbrs, Fowler St, architects for garage, filling station at St. Hilda St for S. Shields Carriage and Motor Co.

Stockton-on-Tees. Petch and Fermaud, 12 Seymour St, W.C.2, architects for W. H. Smith warehouse.

Stokesley. J. T. Bell and Sons, Market Chmbrs, Newcastle, plan 3,000 Hemlington estate houses.

Sutton and Cheam. M. J. Gleeson (Contractors), Haredon Hse, London Rd, N. Cheam, plan 116 Christchurch Park flats.

Thornbury R.D.C. Tender: 121 dwellings on four sites. Architect.

Tyldesley. Bridgewater Estates Ltd., Worsley, Swinton, Manchester, plan 100 Henfold Rd houses.

Tynemouth. Cussins (Contractors), The Drive, Gosforth, Newcastle, plan multi-storey East St developments.—Castles Ltd., 135 Tynemouth Rd, N. Shields, contractors for £43,716 old people's hostel, Stanton Rd.

Uxbridge. D. Stern and Ptnrs, 24 Gloucester Pl, W.1, architects for Lynne Developments Ltd. 21 Warren Farm flats.

Warwick B.C. Tender: 27 houses and bungalows, East End clearance area. Engineer.

Washington U.D.C. Tender: 28 flats, 61 houses, Village La. Engineer.

West Lothian. D. B Gunn (Builders), 16 Young St, Edinburgh, plan 100 Bathgate houses on 22-acre site.

Whickham. W. Dixon and Son, 1 Collingwood St, Newcastle, architects for houses for H. Kindred Ltd. at Sunniside.

Wigan. E. Rylance and Sons, 43 St. James's Rd, Orrell, Upholland, Lancs, plan Park Brook La and Shevington La houses.

Wolverhampton B.C. Tender: 58 Essington Way dwellings and garages. Engineer.

Worthing. Cotch and Ptnrs, 26 Regency Sq, Brighton, architects for 10-storey flats, Brighton Rd, for Westminster Constr. Co.— S. C. Phillips and Kirk, Sterling Chmbrs, 32 Chapel Rd, architects for 100 Harefield Nurseries site flats for R. H. Saunders.— L. H. Fewster and Gamble, 5 Liverpool Gdns, architects for 30 Nelson Rd area flats.

NEW COMPANIES

Extracted from the Register issued by Jordan and Sons Ltd., 116 Chancery La, W.C.2.

Anglian Electrical (Repairs) Co. Ltd. Nom. cap.: £5,000. Dirs. not named. Subs.: Cecil E. Goldsmith and Mrs Joan M. Goldsmith, 11 Eleanore Rd, Colchester.

Daine Electric Ltd., 16 Regent St, Nottingham. To take over the business of "Bulwell Electronics" carried on by A. Russell and Derek Nightingale at 271 Main St, Bulwell, Nottingham, etc. Nom. cap.: £2,500. Dirs.: Alec Russell, Mrs Olive Russell and Derek Nightingale.

Electronic Prototypes Ltd., 9 Bedford Sq, W.C.1. To take over business of an electronic engineer carried on at 42a High St, Harrow-on-the-Hill, by F. W. Everitt, etc. Nom. cap.: £2,500. Dirs.: Fredk. W. Everitt and Gordon C. Douglas.

Euratrom Electronics Ltd., 73-5 Whitworth St, Manchester 1. Nom. cap.: £500. Dirs.: V. R. Galzy and G. Washington.

Firth Cleveland-Laing Ltd. To take over such rights as the company may be able to obtain with a view to the exploitation of the inventions of Herr Nikolous Laing in the field of fans, including tangential fans, pumps, aerodynamic and hydrodynamic and similar equipment, etc. Nom. cap.: £25,000. Dirs not named. Subs.: J. A. S. Hamilton and J. M. Beale, 18 Austin Friars, E.C.2.

Fridge-Ineers Ltd. Inventors, designers, constructors and manufacturers of and dealers in refrigerators, etc. Nom. cap.: £500. Dirs.: John S. McLean, 18 Golf Rd, Port Talbot and Edna Barber, 9 Golf Rd, Port Talbot.

Greenaway, Swanson and Co. Ltd., 15 Broad St, Bath. Manufacturers, designers, selling agents and merchants of electronic, electric and mechanical machines, instruments, etc. Nom. cap.: £2,000. Dirs.: Paul B. Greenaway and Hugh Swanson.

P. T. Hewstone and Co. Ltd., 2 Ladywell Rd, S.E.13. To take over business of electrical engineers and contractors carried on at 79 Mycenae Rd, S.E.3, by P. T. Hewstone and E. W. Sayer, etc. Nom. cap.: £5,000. Dirs.: Philip T. Hewstone and Eric W. Sayer.

Hillside Electric (Potters Bar) Ltd., 6 Stone Bldgs, Lincoln's Inn, W.C.2. Nom. cap.: £1,000. Dirs.: to be appointed by the subs. Subs.: P. Loose and M. Chadwick.

H.L.G. (Electrical Products) Ltd., 2 Mount St, Manchester 2. Nom. cap.: £100. Dirs.: Gerald Ross, Fredk. W. Hardy and Donald C. R. Hutchings.

A. Holmes and Son (Electric) Ltd., 6 Meadowhead, Sheffield 8. Nom. cap.: £5,000. Dirs.: A. Holmes and K. J. Holmes.

R. Hyams and Sons (Electronics) Ltd. Nom. cap.: £100. Dir.: Raphael Hyams, 8 Bridgewater Ct, Bridgewater Rd, Wembley. Sub.: Mrs M. J. Hyams.

Hydrovolt Ltd., 2 Church St, Helston, Cornwall. Manufacturers of and dealers in artificial lighting apparatus, electrical plant, etc. Nom. cap.: £5,000. Dirs.: Albert E. Ashworth and Gordon J. Dunnell.

Instron Ltd. Manufacturers of and dealers in mechanical and electrical equipment and devices, etc. Nom. cap.: £1,000. Dirs. to be appointed by subs. Subs.: Thomas G. Denne and Jack Whitmore, 4 Arundel St, W.C.2.

McCarthy Electrical Installations Ltd., 95 Burns Rd, Harlesden, N.W.10. Nom. cap.: £500. Dirs.: Charles F. McCarthy and Lillian McCarthy.

R. H. Minns Electronics Ltd., 78 Old Broad St, E.C.2. Nom. cap.: £1,000. Dirs.: Richard H. Minns, Mrs Sybil Minns and Brian Bennett.

Modern Electric (West Wales) Ltd., 59 Eversley Rd, Sketty, Swansea. Electrical engineers, etc. Nom. cap.: £3,000. Dirs.: Benjamin G. Davies and Mrs Edith S. Davies.

Musitron Ltd., 72 MacLeod Rd, S.E.2. Electrical engineers, etc. Nom. cap.: £100. Dirs.: Reginald Routh and Gerald R. Walton.

Neon Excelda (Developments) Ltd. Manufacturers of and dealers in electrical advertising signs, neon signs and display lighting, etc. Nom. cap.: £100. Dirs. to be appointed by the subs. Subs.: Ethel E. James, 9 Hamlet Rd, Birmingham 28; and Alan G. Buggins, 52 Glen Rise, Kings Heath, Birmingham.

Pulford and Jelly Electrics Ltd., 154 Nedham St, Leicester. Manufacturers of and dealers in refrigerators, washing machines, vacuum cleaners, etc. Nom. cap.: £2,000. Dirs.: Horace E. Jelly, Alan H. Pulford, Mrs Doreen V. Jelly and Mrs Margaret I. Pulford.

Redicord Ltd., 46 and 47 Frith St, W.1. Manufacturers and sellers of electrical, electronic equipment, etc. Nom. cap.: £10,000. Dirs.: Nevvar Hickmet and Leonard G. Piggott.

S. and K. Electrics Ltd., 172 Staniforth Rd, Sheffield 9. To take over the business carried on by L. M. Smith at Sheffield as "Lawrence," etc. Nom. cap.: £1,000. Dirs.: Lawrence M. Smith and Frederick Key.

Sainsbury (Electric) Ltd., 34 Heol Iscoed, Rhiwbina, Cardiff. Electricians, etc. Nom. cap.: £100. Dirs.: Walter Sainsbury and Walter R. Sainsbury.

D. G. Shipton Ltd., 94a Stoney Stanton Rd, Coventry. Electrical engineers and contractors, etc. Nom. cap.: £3,000. Dirs.: Dennis G. Shipton, Edward W. Saint, Lily Shipton and Florence E. Saint.

Simonswood Electrical Co. Ltd., 17 Leeside Close, Kirkby, nr. Liverpool. Nom. cap.: £1,000. Dirs.: Richard G. Robinson and Harry D. Watkin.

P. S. Snow and Co. Ltd., 58 Church Hill Rd, Thurmaston, Leics. To carry on the business of electrical engineers, etc. Nom. cap.: £100. Dirs.: Peter S. Snow and Mildred Snow.

Joseph Stanyer Ltd., 1 Park St, Shifnal, Salop. Manufacturers of and dealers in electrical goods, etc. Nom. cap.: £1,000. Dirs.: Joseph Stanyer and Mrs Mollie D. Stanyer.

Tarring Electrical Ltd., 141 Tarring Rd, Worthing, Sussex. Nom. cap.: £500. Dirs.: Harold C. Goble and Roy D. W. Harland.

Gazette Announcements

BANKRUPTCY ACTS

Receiving Orders

Bangor. V. L. Morgan, electrician, of "Woodlands," Bishopwood Rd, Prestatyn, Flints. Receiving order dated 23 June.

Sheffield. J. Crampton, electrical retailer, carrying on business as Grosvenor Electrics at 125 Frederick St, Rotherham, and formerly as Grosvenor House Electrical Products at 147 Askern Rd, Bentley. Receiving order dated 24 June.

Manchester. R. H. Dumbell, electrical goods retailer, carrying on business as L. and D. Electrics, at 330 Ashton Old Rd, Openshaw, and formerly in partnership at 233 City Rd, Hulme. Receiving order dated 27 June.

Intended Dividend

Bristol. E. W. Williams, domestic appliance retailer, lately carrying on business with another as R. and W. Electrical Services at 9a Locking Rd, Weston-super-Mare. Last day for receiving proofs for intended dividend: 13 July, to trustee: P. W. Hort, 28 Baldwin St, Bristol 1.

Public Examinations

Nottingham. R. M. Townroe, retailer of domestic electric appliances, carrying on business at 13 Woodhouse Rd, at Pelham Rd and Somersall St, Mansfield, and also formerly at 65 Gateford Rd, Worksop. Public examination: 10 a.m. 1 Sept., at Court Hse, St. Peter's Gate, Nottingham.

Salford. H. Vickers, electrical goods retailer, formerly carrying on business as Victric Co., at 425 Bury New Rd, Higher Broughton. Public examination: 10.30 a.m. 2 Sept., at Court Hse, Encombe Pl, Salford 3.

Croydon. A. J. D. Cooper and R. W. Hutchings, electrical domestic retailers, carrying on business together as Roydon Domestic at 24 Lewisham Rd, S.E.13. Public examination: 11 a.m. 15 Sept., at County Court, Scarbrook Rd, Croydon.

Application for Discharge

High Court of Justice. F. E. Thorne, electrician, of 44 Cranhurst Rd, N.W.2. Order made on 17 May: discharged as from 17 May, 1961.

Release of Trustee

Exeter. P. J. Elworthy, radio, television and electrical engineer, carrying on business at 123 Cowick St, St. Thomas. Trustee: D. H. Dunn, 17 Southernhay West, Exeter, released as from 13 April.

COMPANIES ACTS

Frank Hancock (1939) Ltd. Creditors to send details to liquidator, P. J. Snow, 17 Albion St, Hanley, by 22 July.

Macness Ltd. First meetings of creditors and contributories to be held at Room 401, Inveresk Hse, 346 Strand, W.C.2, on 12 July, at 11.30 a.m. and 12 noon, respectively.

Lydiate Television and Electrical Co. Ltd. Creditors to send details to liquidator, C. A. Huntington, 41 North John St, Liverpool 2, by 1 Aug.

Modern Electrical (Appliances) Ltd. Meetings of members and creditors to be held at Brotherton Chmbrs, Westgate, Leeds 1, on 29 July at 11.30 and 11.45 a.m. respectively.

H. W. Sale (Engrs.) Ltd. Mr W. Le'Resche Hand appointed liquidator at extraordinary general meeting on 16 June. Creditors to send details to liquidator by 31 July.

Telecom Services Ltd. Mr K. D. Gilpin, appointed liquidator at extraordinary general meeting on 13 June for the purpose of voluntarily winding-up. Creditors to send details to liquidator at 60A Station Rd, Upminster, Essex, by 31 July.

Direcsel Ltd. Mr G. H. Eaves, 47 Mosley St, Manchester 2, appointed liquidator as from 1 June.

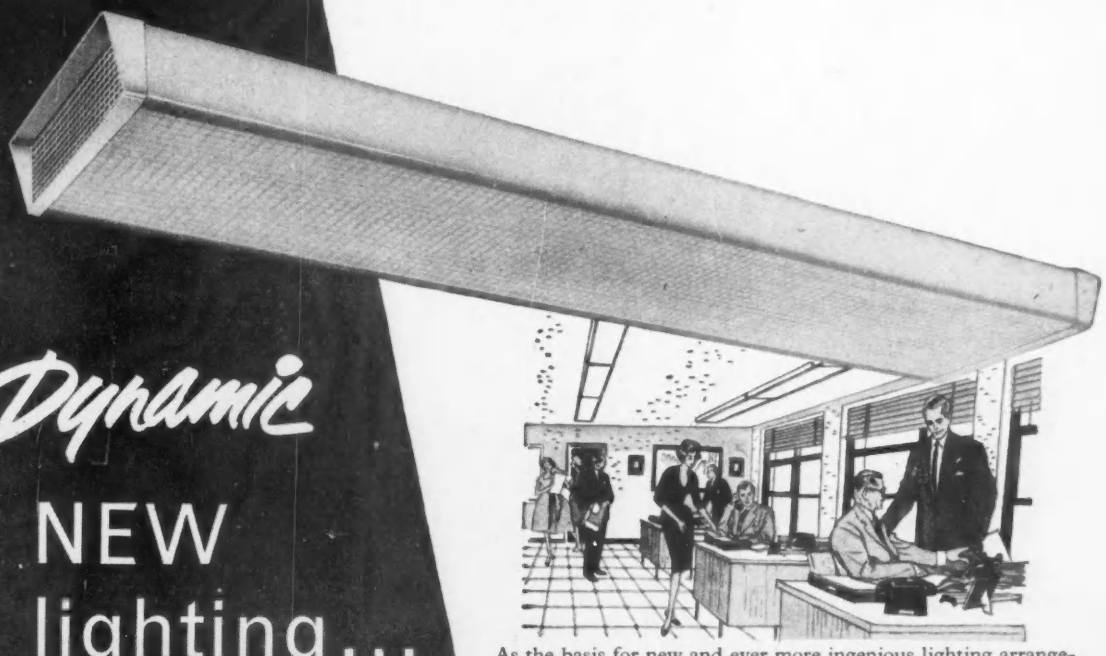
Sigma Electrical Mnfg. Co. Ltd. Mr W. E. Quance, York Hse, 38 Gt. Charles St, Birmingham 3, appointed liquidator at extraordinary general meeting on 21 June for the purpose of voluntarily winding-up. Creditors to send details to liquidator by 15 July. Formal notice: creditors to be paid in full.

Central Electrical Co. (Colchester) Ltd. General meeting of members to be held at 8 West Stockwell St, Colchester, on 29 July, at 2.30 p.m., to receive the liquidator's report.

P.E.A.K. Electrical Co. Ltd. Meeting of creditors to be held at 6 Bedford Corner, W.14, on 19 July, at 11 a.m.

Domestilec Ltd. Creditors to send details to liquidator: R. McNeil, 43 Church Rd, Hove, by 30 July. Formal notice: creditors to be paid in full.

Northern Electrical Servicing Co. (Darlington) Ltd. Meetings of members and creditors to be held at 6 Victoria Rd, Darlington, on 25 July, at 10 and 10.15 a.m., respectively, for the purpose of having an account laid before them.



Dynamic NEW lighting...

As the basis for new and ever more ingenious lighting arrangements, 'Flo-line' fittings open up for the lighting specialist tremendous opportunities for developing new business.

BENJAMIN REGD. FLO LINE

for those who design with light

'Flo-line' combines the outstanding efficiency of Benjamin fluorescent lighting with exciting and original design of an outward simplicity, making for easy harmony with decorative schemes.

The minicell louvre is combined in one unit with translucent side panels to make an all plastic diffuser of entirely new characteristics.

Comfortable yet cheerful seeing conditions are ensured, with high illumination values.

Controllable upward light. Ceiling or pendant mounting. Access to lamps and control equipment is quick and easy. Side panels are double walled for strength.

Apparent depth of fitting only 3½ in. Total depth 4⅜ in. Half inch cube spaces in louvre give 45° cut-off.

Installation accessories include couplers for continuous line arrangements and channel junction boxes for geometrical layouts.

Uses 2 x 5 ft. 80-Watt lamps. Quick or switch start control gear.

The entire louvre swings down for cleaning and maintenance.

better lighting by BENJAMIN

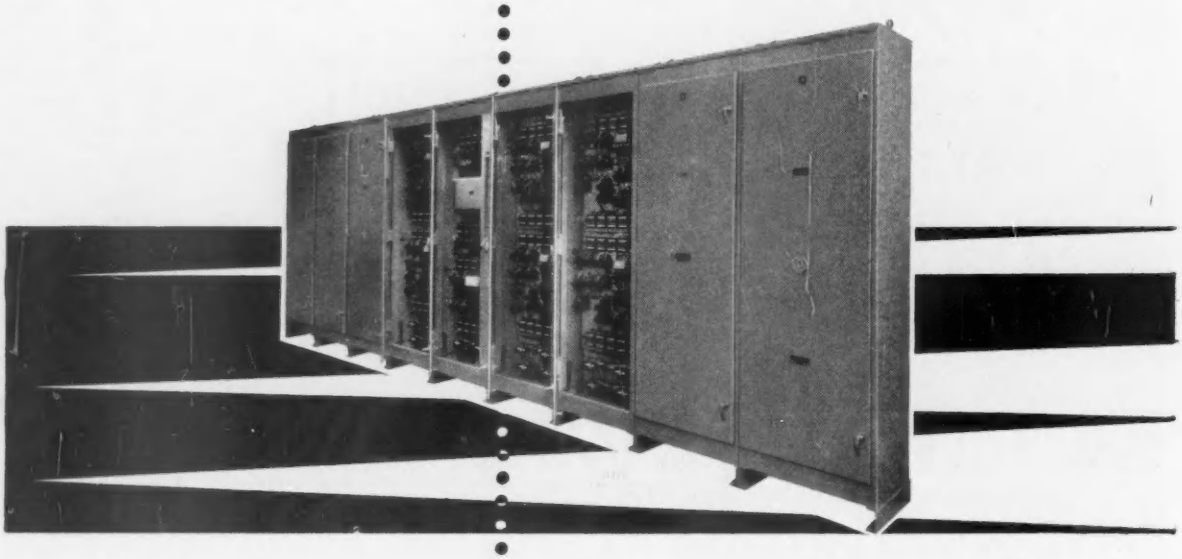
BRITISH LIGHTING COUNCIL BLC MEMBER

THE BENJAMIN ELECTRIC LIMITED · TOTTENHAM · LONDON N.17
Tel: Tottenham 5252. *Grams:* Benjalect, Southtot, London

BIRMINGHAM: 5 Corporation Street · *Tel: Midland 5197*
LEEDS: 49 Basinghall Street · *Tel: Leeds 25579*
BRISTOL: Royal London Building, Baldwin Street · *Tel: Bristol 28406*

Smee's B158

SPECIAL PURPOSE CONTROL PANELS BY Donovan



This **SPECIAL** 9-door switchboard controlling a 19-station Metalworking In-Line Transfer Machine may look like any other switchboard **BUT—**

STANDARD, PROVEN Donovan Contactors, Relays, Overloads Isolators and accessories, are used throughout and in addition the panels are **plug-in** for quick replacement and maintenance—**valuable feature only offered by Donovan.**

Senior Executives and Buyers desiring a comprehensive List of Donovan standard and special products are invited to apply for copies of the Donovan Catalogue.

THE DONOVAN ELECTRICAL CO. LTD.

77-82 GRANVILLE STREET, BIRMINGHAM, 1

LONDON DEPOT: 148-151 York Way, N.7. GLASGOW DEPOT: 22 Pitt Street, C.2

Sales Engineers available in LONDON · BIRMINGHAM · MANCHESTER · GLASGOW · BELFAST · BOURNEMOUTH

CLASSIFIED ADVERTISEMENTS

TENDERS INVITED

BOROUGH OF WANSTEAD AND WOODFORD

SNAKES LANE STREET LIGHTING SCHEME
GROUPS "A" AND "B"

TENDERS are invited for the installation of colour corrected mercury street lighting systems in Snakes La East (Group "A"), Snakes La West (Group "B") and The Broadway (Group "B"). The works include taking down existing short gas columns, provision and erection of new equipment and appurtenant works.

Tender documents may be obtained from the Borough Engineer, Municipal Offices, Woodford, E.18, upon payment of £2 deposit on receipt of a bona fide tender by noon on Monday, 25 July, 1960. (R 336)

APPOINTMENTS VACANT

SOUTHERN ELECTRICITY BOARD

CONTROL ENGINEER

SUB-AREA Engineering Department of No. 1 (Southall) Sub-Area, located at North Hyde Substation, Hayes, Middlesex. Salary: N.J.B. Class M, Grade 10 (£1,080/£1,215 per annum, plus 10% Shift Allowance, plus London Allowance). N.J.B. Conditions of Service.

The duties of the post will be the control of loading and switching operations on an interconnected distribution network operating at voltages up to and including 66 kV.

The successful candidate will be required to contribute to the Electricity Supply (Staff) Superannuation Scheme, if eligible.

Applications on forms obtainable from the Sub-Area Secretary, 2-6 Windmill La, Southall, Middlesex, and returned to him, quoting Z.1217, not later than 18 July, 1960. (R 351)

NORTH OF SCOTLAND HYDRO-ELECTRIC BOARD
Dundee Area

APPLICATIONS are invited for the following posts at Carolina Port Power Station.

SENIOR CHARGE ENGINEER

Experience is necessary in supervising, controlling and efficiently operating all aspects of power station equipment, together with ability to deal with shift-staffing matters.

Technical qualification of Higher National Standard are desirable.

Salary in accordance with Class F, Grade 7 (£910 x £15—£955) of the National Joint Board Agreement, plus 10% shift allowance. Superannuation Scheme.

ASSISTANT CHARGE ENGINEER

Experience is desirable in synchronising the loading of large turbo-alternators, the switching and load distribution of systems of voltages up to 132 kV and in power station electrical plant generally.

Technical qualification of Higher National Standard is desirable.

Salary in accordance with Class F, Grade 9 (£815 x £15—£860) of the National Joint Board Agreement, plus 10% shift allowance. Superannuation Scheme.

Application forms are obtainable from the Area Manager, 7 Dudhope Crescent Rd, Dundee, and should be returned by Friday, 22 July, 1960. (R 337)

UNIVERSITY OF LONDON
Senate House

DEPUTY ENGINEER

APPLICATIONS are invited from professionally qualified Engineers with practical experience in the control of staffs and the maintenance of large-scale heating, and electrical installations for the post of Deputy Engineer located at Senate Hse, Bloomsbury. He will be responsible to the Resident Engineer for the provision and supervision of all engineering services for the developing Bloomsbury site, including direct electric, oil-fired and thermal storage heating installations, ventilation and air-conditioning plant. Salary scale £1,050 x £50—£1,350 (starting point according to age and experience). Generous leave, superannuation and family allowances. Applications, stating full details of training and experience, by 1 September, 1960, to the Maintenance Officer, University of London, Senate Hse, W.C.1, from whom further particulars may be obtained. (R 331)

CENTRAL ELECTRICITY GENERATING BOARD
East Midlands Division

STATION CHEMIST
BURTON-ON-TRENT POWER STATION
VACANCY No. 165/60.

APPLICATIONS are invited for the position of Station Chemist at Burton Power Station, Wetmore Rd, Burton-on-Trent.

Previous experience in a power station laboratory is essential and candidates should hold the Higher National Certificate in Chemistry.

Applicants must be familiar with the sampling and analysis of coal, water and oil and the interpretation of the analytical results.

Salary will be in accordance with Class E, Grade 7 (£845/£930 per annum) of the National Joint Board Agreement.

Closing date for receipt of applications: 15 July, 1960.

ASSISTANT SHIFT CHARGE ENGINEER
COVENTRY POWER STATION
VACANCY No. 166/60.

Applications are invited for the position of Assistant Shift Charge Engineer at Coventry Power Station, Alderman's Green, Coventry.

Applicants are required to take charge of shift operation of Boiler House plant and must possess a sound technical training, a good general engineering experience, and knowledge of the control and operation of water tube boilers, ancillary plant and the efficient combustion of fuels and Chain Grate Stokers.

Salary will be in accordance with Class G, Grade 9 (£845/£930 per annum of the National Joint Board Agreement, plus shift enhancement.

Closing date for receipt of applications: 15 July, 1960.

These appointments will be pensionable within the terms and conditions of the Electricity Supply (Staff) Superannuation Scheme.

Applications should be submitted on the official form AE6/ACT which may be obtained from the Station Superintendent concerned, and should be returned to the Station by the date stated.

O. S. WOODS,
Divisional Controller.
(R 354)

THE NORTH EASTERN ELECTRICITY BOARD
Wear Sub-Area

APPLICATIONS are invited for the following appointments, all subject to N.J.B. Agreement. Applicants must have had sound practical training and experience in construction, operation and maintenance of H.V., M.V. and L.V. overhead and underground distribution networks, substation plant and equipment. Preference will be given to candidates with qualifications leading to Corporate Membership of I.E.E.

SECOND ASSISTANT DISTRICT ENGINEERS
DURHAM AND SUNDERLAND

Salaries: Schedule A, Class G, Grade 7, £950/£1,055.

SECOND ASSISTANT DISTRICT ENGINEER
CROOK DISTRICT

Salary: Schedule A, Class E, Grade 7, £845/£930.

THIRD ASSISTANT DISTRICT ENGINEERS
CHESTER-LE-STREET
DURHAM AND SUNDERLAND

Salaries Schedule A, Class G, Grade 9, £845/£930.

Applications stating age, qualifications and experience to be received by Assistant Secretary (Establishments), The North Eastern Electricity Board, G.P.O. Box No. 117, Carliol Hse, Newcastle upon Tyne 1, within ten days of the appearance of this advertisement. (R 344)

YORKSHIRE ELECTRICITY BOARD
No. 5 (Wakefield) Sub-Area

FOURTH ASSISTANT ENGINEER
(DISTRIBUTION DESIGN)

APPLICANTS must hold at least the Higher National Certificate in Electrical Engineering and should have had some experience in the construction, operation and maintenance of distribution networks, and in the planning of H.V. and L.V. overhead and underground distribution systems, and the design of substations. Experience in the preparation of reports, load estimates and capital budgets is desirable.

Salary: N.J.B. Class L, Grade 13 (Scale 7), £845/£930 per annum.

CASTLEFORD DISTRICT
THIRD ASSISTANT DISTRICT ENGINEER

Applicants should have had practical training and experience in the construction, operation and maintenance of H.V. and M.V. overhead and underground distribution networks, substation plant and ancillary equipment.

Candidates must have attained the technical standard of the Higher National Certificate in Electrical Engineering or equivalent qualifications. Candidates must be prepared to reside in the district and undertake standby duties.

Salary: N.J.B. Class G, Grade 9 (Scale 7), £845/£930 per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 5 (Wakefield) Sub-Area, Yorkshire Electricity Board, 1a Denby Dale Rd, Wakefield, not later than 22 July, 1960.

No. 7 (Grimsby) Sub-Area

GRIMSBY DISTRICT
THIRD ASSISTANT ENGINEER
(INSTALLATIONS)

Applicants should have practical experience in the supervision of the day to day work of Installation Inspectors and Electricians engaged on the servicing of consumers' apparatus and installations. An appropriate technical qualification will be an advantage.

Salary: N.J.B. Class H, Grade 10 (Scale 7), £845/£930) per annum.

Applications, giving full details of age, qualifications and experience, together with the names of two referees, should be forwarded to the Manager, No. 7 (Grimsby) Sub-Area, Yorkshire Electricity Board, Moss Rd, Grimsby, not later than 22 July, 1960. (R 350)

Advertisements should be sent to the Classified Advertisement Dept., Electrical Times, Sardinia House, Sardinia Street, London, W.C.2, before 10 a.m. on TUESDAY of the week of issue. Official Displayed Advertisements are charged at 40s. per inch, and all other classified advertisements at 3s. per line. Situations Wanted four insertions at twice the single insertion rate. Fee for Box Number and postage on replies 2s.

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Project Group
THIRD ASSISTANT ENGINEER
(MECHANICAL)

APPLICATIONS are invited for the position of Third Assistant Engineer (Mechanical) at Uskmouth "B" Power Station site.

Applicants should have had a fundamental training in mechanical engineering, including workshops and should preferably have experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Appropriate technical qualifications will be an advantage.

The salary will be in accordance with Schedule C, Grade 7, Scale 13, £1,090/£1,410 per annum, of the National Joint Board agreement.

Applications should be made on standard form AE.6 available from the Administrative Officer, Midlands Project Group, P.O. Box No. 314, Birmingham 30, and should be returned to him not later than 20 July, 1960.

Envelopes should be marked "Confidential" Staff Vacancy Notice No. MPG.49/60. (R 338)

THE NORTH WESTERN ELECTRICITY BOARD
SENIOR ASSISTANT ENGINEER
(AGRICULTURAL DEVELOPMENT)
COMMERCIAL DEPARTMENT
AREA BOARD HEADQUARTERS
CHEETWOOD ROAD, MANCHESTER 8

APPLICANTS should have a sound knowledge of uses of electricity in agriculture and horticulture. The duties are primarily concerned with acting as a specialist adviser on such applications and maintaining contact with agricultural interests throughout the area. A sound knowledge of practical farming is desirable. Preference will be given to applicants possessing technical qualifications either in engineering or agriculture.

Salary scale: £1,365/£1,730 p.a. Grade BX 3. N.J.B. Conditions.

Applications on forms obtainable from and returnable to the Secretary, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 25 July, 1960.

DEMONSTRATOR
CENTRAL DISTRICT, MANCHESTER

Applicants should be experienced in demonstrating all types of domestic electrical equipment and commercial catering equipment, to public audiences, in Service Centres and on consumers' premises, they should hold the E.A.W. Certificate in Electrical Housecraft.

Salary scale: £600/£700 per annum. Grade 1. N.J.C. Conditions.

FOURTH ASSISTANT ENGINEER
(CONTRACTING)
SUB-AREA COMMERCIAL DEPARTMENT
MANCHESTER

Applicants should have experience in the control and supervision of all classes of contract wiring, preparation of estimates and specifications, supply of information to all classes of consumers on electricity utilisation tariffs, also the preparation of space heating schemes, etc.

Salary scale: £890 x £20—£990 per annum. Grade M.13. N.J.B. Conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 18 July, 1960.

DEMONSTRATORS
BLACKBURN DISTRICT

Applicants should be experienced in the demonstration and sale of electrical appliances within Service Centres and to audiences elsewhere. Duties will include general assistance in Service Centre work. The possession of a suitable qualification is desirable.

Salary scale: £600/£700 per annum. Grade 1. N.J.C. Conditions.

Applications on a form obtainable from and to be returned to Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 18 July, 1960. (R 333)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
DEMONSTRATOR

REQUIRED in the Wrexham District of the Board's No. 4 Sub-Area. Salary within range £600/£700 per annum (N.J.C. Grade 1).

Candidates should have a good knowledge of electrical appliances, and be competent to give demonstrations of cooking, laundering and housecraft subjects. The possession of a recognised Diploma in Domestic Science or other approved certificate desirable.

Possession of a valid motor vehicle driving licence would be an advantage.

Appointment subject to medical examination. Pension Scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, nr. Wrexham, or from any District Office. Closing date: 21 July, 1960. (R 330)

ISLE OF MAN ELECTRICITY BOARD
ENGINEER AND SECRETARY

APPLICATIONS are invited for the appointment of Engineer and Secretary to the Board at a salary of £1,950 per annum.

Applicants should be Corporate Members of the Institution of Electrical Engineers with experience in all branches of electricity supply work.

Further information regarding the appointment and a form of application obtainable from the Engineer and Secretary, Isle of Man Electricity Board, Harcroft, Douglas, Isle of Man. (R 308)

BAHRAIN STATE ELECTRICITY DEPARTMENT
REQUIRE A MAINTENANCE ENGINEER

MINIMUM qualification: H.N.C. in Electrical Engineering.

Salary: Payable in rupees equivalent to £1,575 rising to £1,890 a year.

Age preferably 28 to 35. Man required with power station experience with bias towards instrument overhaul and circuit testing, must be prepared to do shift work for approximately the first 12 months.

Duties include the electrical maintenance of gas turbine engine driven generating sets, 11 kV switchgear and all associated auxiliaries.

Contract for two years in first instance.

Kit and baggage allowance £60. Gratuity at rate of one month's salary for each year of service. Liberal leave on full salary. Free passages for officer, wife and two children under 18 years. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50960/EE. (R 318)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

APPLICATIONS are invited for the appointment of MAINTENANCE ENGINEER (MECHANICAL) at Rugeley Power Station.

The successful applicant would be directly responsible to the Maintenance Superintendent for all mechanical maintenance on the Station.

Candidates should have served a recognised apprenticeship and have had experience with the maintenance of large modern turbines, P.F. fired boilers, and coal and ash handling plant.

Supervisory experience and good organising ability is essential, and the possession of technical qualifications to the standard of H.N.C. Mech. would be an advantage.

Salary to be in accordance with N.J.B. Schedule A, Grade 6, Class L, £1,340/£1,515 per annum.

Apply, quoting Vacancy Number 164/60MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs, to whom they should be returned not later than 22 July, 1960. (R 328)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Stirling Area
SENIOR COMMERCIAL ASSISTANT
(Vacancy No. 46/60)

REQUIRED in the Area Commercial Officer's Department at 13 Murray Pl, Stirling, to undertake sales and advisory work associated with rural development.

Salary: N.J.C. Grade 5, £885 x £25—£960. The post is superannuable. Applications, on the standard form obtainable from the undersigned, to be submitted not later than 18 July, 1960.

JAMES G. CURTIS,
Manager.

"Woodlands,"
St. Ninians Rd,
Stirling. (R 326)

ELECTRICAL ENGINEERING ASSISTANTS

REQUIRED with experience of any of the following:

(a) Preparation of specifications for electrical installation in buildings.

(b) Planning, design or technical aspects of installation or maintenance of electric lifts.

(c) Negotiations in connection with electricity supplies, choice of tariff and apportionment of costs.

Prospects of advancement in entry grade up to £1,250 for those obtaining H.N.C. (Electrical).

Staff restaurant. Pension scheme. Form from Chief Engineer (GS/ET/1676/7), L.C.C., County Hall, S.E.1. (R 332)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands and East Midlands Region
RESEARCH AND DEVELOPMENT
DEPARTMENT
APPOINTMENT OF ASSISTANT CHEMISTS

APPLICATIONS are invited for the undermentioned appointments as Assistant Chemists within the Regional Research and Development Organisation:

1. VACANCY No. MEM/80.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £990 per annum, (b) £1,055 per annum, (c) £1,130 per annum.

Two chemists are required initially for measurements and research work on air pollution. The duties will involve routine analyses, maintenance of instruments and assessment of instrumental analyses, at various points in the Trent Valley. The successful candidates will in the first instance be based in Nottingham and it is essential that the applicants should hold a current driving licence.

2. VACANCY No. MEM/81.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £1,215 per annum, (b) £1,305 per annum, (c) £1,410 per annum.

Two posts are available within the research organisation and will be based in Birmingham. One will be concerned with atmospheric pollution work and the successful applicant must be prepared to supervise field work, and he should, therefore, hold a current driving licence. He will also be required to undertake other more general duties within the Research Organisation as conditions demand.

For the second post the successful candidate will probably be required to undertake field work of a chemical nature in power stations.

The minimum qualification for these posts is the Higher National Certificate in Chemistry, but preference will be given, especially for the higher posts, to holders of University degrees or to those qualified for admission to the corporate membership of the Royal Institute of Chemistry.

Applications should be submitted on Form AE6/ACT to the Assistant Regional Secretary (Personnel), 53 Wake Green Rd, Moseley, Birmingham 13, quoting the above Vacancy Nos., to arrive not later than Saturday, 30 July. (R 325)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

STEVENAGE DEVELOPMENT CORPORATION

Chief Architect's Department

APPLICATIONS are invited for appointment as Inspector (Electrical Installations) on New Towns Salary Grade APT II £765/£880, starting salary according to qualifications and experience. Candidates should have good experience of electrical installation work and preferably hold City and Guilds Electrical Engineering Final Certificate or equivalent qualifications.

Housing accommodation will be available in due course in an appropriate case.

Applications giving full details of experience and the names of two referees to be sent to the Chief Administrative Officer, Aston House, Aston, Nr. Stevenage, Herts, by Monday, 18 July, 1960. (R 343)

THE SOUTH WALES ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for an appointment as District Commercial Engineer in the Pontypridd and Caerphilly District of the Cardiff and East Central Area of the Board.

The salary for the position will be in accordance with Scale 13 (£1,245/£1,410) of the Common Salary Scale of the National Joint Board Agreement for the Electricity Supply Industry.

The District territory contains the Urban District Councils of Pontypridd, Caerphilly, Bedwas and Machen, together with portions of two adjoining Rural District Councils. The area totals 58 sq. miles. Of electricity supplied to 26,000 consumers, 80% is for industry.

Prospects of development are good, both for industrial expansion in the District and for commercial and domestic expansion. The Eastern sector of the District is becoming a "dormitory" area for the influx of workers to the industrial projects at Llanwern Steelworks and an intended Car Factory at Cardiff.

The District Office is at Pontypridd and the successful candidate will be required to live reasonably close to the District office.

Applicants should preferably be Chartered Electrical Engineers.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445/447 Cowbridge Rd, East, Cardiff, so as to arrive not later than Saturday, 23 July, 1960. Envelopes should be marked "District Commercial Engineer—133/60."

MECHANICAL WORKSHOP INSTRUCTOR

Applications are invited for the position of Mechanical Workshop Instructor in the Board's Apprentice Training School, Newport Rd, Cardiff.

The salary for the position will be in accordance with Grade 4 (£795/£870) or Grade 5 (£885/£960) of the National Joint Council (Administrative and Clerical Grades) Agreement for the Electricity Supply Industry, and the precise duties of the post will be decided according to the qualifications and experience of the successful applicant.

The successful applicant will be required to give instruction to apprentices in workshop practice with emphasis on the correct use of hand tools and elementary instruction on machine tools. He will also be required to lecture on related subjects.

The possession of the Ordinary National Certificate in Mechanical Engineering, or its equivalent, is desirable.

Applications stating age, present position, present salary, qualifications and experience should be addressed to the undersigned at St. Mellons, Cardiff, so as to arrive not later than Saturday, 23 July, 1960. Envelopes should be marked "Mechanical Workshop Instructor—134/60."

R. G. WILLIAMS,
Secretary.
(R 319)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
TWICKENHAM AND RICHMOND DISTRICT

SALARY: £800/£875 per annum, plus London Allowance under N.J.B. Class F, Grade 9. Superannuable. Applicants should have had a good general education, be technically trained up to Higher National Certificate standard and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications, quoting ET and naming two referees on forms from District Manager, Seeboard, 42 York St, Twickenham, Middx, by 20 July, 1960.

SENIOR DEMONSTRATOR
WOKING DISTRICT

Salary within the range £700 x £25—£775 p.a. under N.J.C. Grade 2. Superannuable. Applicants should hold a recognised qualification in Domestic Science and the E.A.W. Certificate. They should be experienced in giving talks and demonstrations on all types of domestic apparatus and be prepared to work anywhere in the Woking district. The successful applicant will be required to assist in general showroom work. Applications, quoting ET and naming two referees on forms obtainable from Woking Manager, Seeboard, 4 Chobham Rd, Woking, by 20 July, 1960.

GEORGE WRAY,
Secretary.
(R 355)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments in the South Wales Division:

THIRD AND FOURTH ASSISTANT ENGINEER
SYSTEM DESIGN SECTION
TECHNICAL DEPARTMENT
DIVISIONAL HEADQUARTERS

Vacancy No. 170/ET/60.

THIRD ASSISTANT ENGINEER

Salary: AX.6, £1,090/£1,305; AX.7, £1,005/£1,215); AX.8, £925/£1,130); according to experience and qualifications.

FOURTH ASSISTANT ENGINEER

Salary: AX.11, £735/£930. Progression to a higher salary scale will be dependent on qualifications, ability and experience.

The Section is concerned with the investigation of schemes for the extension of the main transmission system in South Wales and has to deal with a wide variety of power system problems including load flow studies, fault investigations and the analysis of system behaviour. The Section has at its disposal a D.C. calculating board and an A.C. network analyser.

Candidates should have a University Degree or Higher National Certificate, and some practical experience in the supply or manufacturing industries would be an advantage.

THIRD ASSISTANT ENGINEER
EFFICIENCY, TESTING AND COMBUSTION SECTION, GENERATION DEPARTMENT
DIVISIONAL HEADQUARTERS

Vacancy No. 171/ET/60.

Salary: AX8, £925/£1,130.

The successful candidate will be required to assist in organising and conducting acceptance tests on new generating plant, routine plant tests and investigations into operational difficulties, and improving power plant performance in power stations within the South Wales Division. A knowledge of standardisation and calibration of test instruments and electronics would be an advantage.

Candidates should have considerable experience of modern power plant, operation and efficiency control, and possess qualifications leading to Corporate Membership of an appropriate professional institution.

Special application forms obtainable from Secretary, South Wales Division, Central Electricity Generating Board, Twyn-y-fedwen Rd, Gabalfa, Cardiff, by 22 July, 1960. (R 349)

CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within, Grade K.9, Scale No. 10, £1,010/£1,130 per annum, plus 10% for shift duties.

A sound technical training and practical experience in the operation and maintenance of a modern power station are required. Appropriate technical qualification desirable. Applicants who previously applied for this position will be reconsidered and need not re-apply.

Apply quoting vacancy number 169/60MD on forms AE6, available from the Station Superintendent, Nechells Power Station, off Aston Church Rd, Nechells, Birmingham 7, to whom they should be returned when completed not later than 22 July, 1960. (R 345)

CITY OF WAKEFIELD

City Engineer's Department

APPOINTMENT OF FOREMAN ELECTRICIAN

APPLICATIONS are invited from apprentice-trained electricians for the appointment of a working foreman who will take charge of a Street Lighting and General Electrical Maintenance Section which is shortly to be set up in the Department.

Preference will be given to applicants who have had previous experience in the maintenance and installation of street lighting apparatus.

Applications together with the names of two referees should be forwarded to the City Engineer, Town Hall, Wakefield (from whom further particulars can be obtained), not later than Friday, 22 July, 1960. (R 347)

EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT

(i) THIRD ASSISTANT ENGINEER
170/60.R.

(ii) FOURTH ASSISTANT ENGINEER
171/60.R.

Candidates for (i) should have had experience in operation and maintenance of H.V. and L.V. overhead and underground systems (including substations), fault location and protection.

Candidates for (ii) should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class F, as follows: (i) Grade 9 V(£800/£875); (ii) Grade II (£690/£785).

Apply by letter within 14 days to the Manager, Gt. Yarmouth District, Eastern Electricity Board, Regent Rd, Gt. Yarmouth, Norfolk.

Northmet Sub-Area

THIRD ASSISTANT ENGINEERS

(a) ST. ALBANS DISTRICT (Ref. 987)
169/60.R.

(b) EDMONTON DISTRICT (Ref. 988)
172/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems (including substations).

Salary: N.J.B. Grade 9 as follows: (a) £875) plus London Allowance.
Class G (£845/£930); (b) Class F (£800/

Apply by letter within 10 days as follows:

(a) F. J. Drake, ASSOC.I.E.E., Manager, St. Albans District, Eastern Electricity Board, 107 St. Peters St, St. Albans, Herts.

(b) C. A. Baker, B.SC.(ENG.), M.I.E.E., Manager, Edmonton District, Eastern Electricity Board, 305 Fore St, Edmonton, London N.9. (R 348)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Project Group
THIRD ASSISTANT ENGINEER
(MECHANICAL)

APPLICATIONS are invited for the position of Third Assistant Engineer (Mechanical) at Uskmouth "B" Power Station site.

Applicants should have had a fundamental training in mechanical engineering, including workshops and should preferably have experience in the manufacture, erection, maintenance and operation of mechanical plant as installed in modern power stations. Appropriate technical qualifications will be an advantage.

The salary will be in accordance with Schedule C, Grade 7, Scale 13, £1,090/£1,410 per annum, of the National Joint Board agreement.

Applications should be made on standard form AE.6 available from the Administrative Officer, Midlands Project Group, P.O. Box No. 314, Birmingham 30, and should be returned to him not later than 20 July, 1960.

Envelopes should be marked "Confidential" Staff Vacancy Notice No. MPG.49/60. (R 338)

THE NORTH WESTERN ELECTRICITY BOARD
SENIOR ASSISTANT ENGINEER
(AGRICULTURAL DEVELOPMENT)
COMMERCIAL DEPARTMENT
AREA BOARD HEADQUARTERS
CHEETWOOD ROAD, MANCHESTER 8

APPLICANTS should have a sound knowledge of uses of electricity in agriculture and horticulture. The duties are primarily concerned with acting as a specialist adviser on such applications and maintaining contact with agricultural interests throughout the area. A sound knowledge of practical farming is desirable. Preference will be given to applicants possessing technical qualifications either in engineering or agriculture.

Salary scale: £1,365/£1,730 p.a. Grade BX 3. N.J.B. Conditions.

Applications on forms obtainable from and returnable to the Secretary, The North Western Electricity Board, Cheetwood Rd, Manchester 8, by 25 July, 1960.

DEMONSTRATOR
CENTRAL DISTRICT, MANCHESTER

Applicants should be experienced in demonstrating all types of domestic electrical equipment and commercial catering equipment, to public audiences, in Service Centres and on consumers' premises, they should hold the E.A.W. Certificate in Electrical Housecraft.

Salary scale: £600/£700 per annum. Grade 1. N.J.C. Conditions.

FOURTH ASSISTANT ENGINEER
(CONTRACTING)
SUB-AREA COMMERCIAL DEPARTMENT
MANCHESTER

Applicants should have experience in the control and supervision of all classes of contract wiring, preparation of estimates and specifications, supply of information to all classes of consumers on electricity utilisation tariffs, also the preparation of space heating schemes, etc.

Salary scale: £890 x £20—£990 per annum. Grade M.13. N.J.B. Conditions.

Application forms to be obtained from the Manager (Staff Vacancy), No. 1 Sub-Area, The North Western Electricity Board, Town Hall, Manchester, P.O. Box 493, and returned to him by 18 July, 1960.

DEMONSTRATORS
BLACKBURN DISTRICT

Applicants should be experienced in the demonstration and sale of electrical appliances within Service Centres and to audiences elsewhere. Duties will include general assistance in Service Centre work. The possession of a suitable qualification is desirable.

Salary scale: £600/£700 per annum. Grade 1. N.J.C. Conditions.

Applications on a form obtainable from and to be returned to Manager, No. 5 Sub-Area, The North Western Electricity Board, Jubilee St, Blackburn, by 18 July, 1960. (R 333)

MERSEYSIDE AND NORTH WALES ELECTRICITY BOARD
DEMONSTRATOR

REQUIRED in the Wrexham District of the Board's No. 4 Sub-Area. Salary within range £600/£700 per annum (N.J.C. Grade 1).

Candidates should have a good knowledge of electrical appliances, and be competent to give demonstrations of cooking, laundering and housecraft subjects. The possession of a recognised Diploma in Domestic Science or other approved certificate desirable.

Possession of a valid motor vehicle driving licence would be an advantage.

Appointment subject to medical examination. Pension Scheme.

Standard application forms obtainable from the Manager, No. 4 Sub-Area, Electricity Hse, Rhostyllen, nr. Wrexham, or from any District Office. Closing date: 21 July, 1960. (R 330)

ISLE OF MAN ELECTRICITY BOARD
ENGINEER AND SECRETARY

APPLICATIONS are invited for the appointment of Engineer and Secretary to the Board at a salary of £1,950 per annum.

Applicants should be Corporate Members of the Institution of Electrical Engineers with experience in all branches of electricity supply work.

Further information regarding the appointment and a form of application obtainable from the Engineer and Secretary, Isle of Man Electricity Board, Harcroft, Douglas, Isle of Man. (R 308)

BAHRAIN STATE ELECTRICITY DEPARTMENT
REQUIRE A MAINTENANCE ENGINEER

MINIMUM qualification: H.N.C. in Electrical Engineering.

Salary: Payable in rupees equivalent to £1,575 rising to £1,890 a year.

Age preferably 28 to 35. Man required with power station experience with bias towards instrument overhaul and circuit testing, must be prepared to do shift work for approximately the first 12 months.

Duties include the electrical maintenance of gas turbine engine driven generating sets, 11 kV switchgear and all associated auxiliaries.

Contract for two years in first instance.

Kit and baggage allowance £60. Gratuity at rate of one month's salary for each year of service. Liberal leave on full salary. Free passages for officer, wife and two children under 18 years. Write to the Crown Agents, 4 Millbank, London S.W.1. State age, name in block letters, qualifications and experience and quote M2A/50960/EE. (R 318)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

APPLICATIONS are invited for the appointment of MAINTENANCE ENGINEER (MECHANICAL) at Rugeley Power Station.

The successful applicant would be directly responsible to the Maintenance Superintendent for all mechanical maintenance on the Station.

Candidates should have served a recognised apprenticeship and have had experience with the maintenance of large modern turbines, P.F. fired boilers, and coal and ash handling plant.

Supervisory experience and good organising ability is essential, and the possession of technical qualifications to the standard of H.N.C. Mech. would be an advantage.

Salary to be in accordance with N.J.B. Schedule A, Grade 6, Class L, £1,340/£1,515 per annum.

Apply, quoting Vacancy Number 164/60MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs, to whom they should be returned not later than 22 July, 1960. (R 328)

SOUTH OF SCOTLAND ELECTRICITY BOARD
Stirling Area
SENIOR COMMERCIAL ASSISTANT
(Vacancy No. 46/60)

REQUIRED in the Area Commercial Officer's Department at 13 Murray Pl, Stirling, to undertake sales and advisory work associated with rural development.

Salary: N.J.C. Grade 5, £885 x £25—£960. The post is superannuable. Applications, on the standard form obtainable from the undersigned, to be submitted not later than 18 July, 1960.

JAMES G. CURTIS,
Manager.

"Woodlands,"
St. Ninians Rd,
Stirling. (R 326)

ELECTRICAL ENGINEERING ASSISTANTS

REQUIRED with experience of any of the following:

(a) Preparation of specifications for electrical installation in buildings.

(b) Planning, design or technical aspects of installation or maintenance of electric lifts.

(c) Negotiations in connection with electricity supplies, choice of tariff and apportionment of costs.

Prospects of advancement in entry grade up to £1,250 for those obtaining H.N.C. (Electrical).

Staff restaurant. Pension scheme. Form from Chief Engineer (GS/ET/1676/7), L.C.C., County Hall, S.E.1. (R 332)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands and East Midlands Region
RESEARCH AND DEVELOPMENT
DEPARTMENT
APPOINTMENT OF ASSISTANT CHEMISTS

APPLICATIONS are invited for the undermentioned appointments as Assistant Chemists within the Regional Research and Development Organisation:

1. VACANCY No. MEM/80.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £990 per annum, (b) £1,055 per annum, (c) £1,130 per annum.

Two chemists are required initially for measurements and research work on air pollution. The duties will involve routine analyses, maintenance of instruments and assessment of instrumental analyses, at various points in the Trent Valley. The successful candidates will in the first instance be based in Nottingham and it is essential that the applicants should hold a current driving licence.

2. VACANCY No. MEM/81.

Salary scale dependent upon qualifications and experience rising to a maximum (a) £1,215 per annum, (b) £1,305 per annum, (c) £1,410 per annum.

Two posts are available within the research organisation and will be based in Birmingham. One will be concerned with atmospheric pollution work and the successful applicant must be prepared to supervise field work, and he should, therefore, hold a current driving licence. He will also be required to undertake other more general duties within the Research Organisation as conditions demand.

For the second post the successful candidate will probably be required to undertake field work of a chemical nature in power stations.

The minimum qualification for these posts is the Higher National Certificate in Chemistry, but preference will be given, especially for the higher posts, to holders of University degrees or to those qualified for admission to the corporate membership of the Royal Institute of Chemistry.

Applications should be submitted on Form AE6/ACT to the Assistant Regional Secretary (Personnel), 53 Wake Green Rd, Moseley, Birmingham 13, quoting the above Vacancy Nos., to arrive not later than Saturday, 30 July. (R 325)

Box No. replies to be addressed to the ELECTRICAL TIMES, Sardinia House, Sardinia Street, London, W.C.2

STEVENAGE DEVELOPMENT CORPORATION

Chief Architect's Department

APPLICATIONS are invited for appointment as Inspector (Electrical Installations) on New Towns Salary Grade APT II £765/£880, starting salary according to qualifications and experience. Candidates should have good experience of electrical installation work and preferably hold City and Guilds Electrical Engineering Final Certificate or equivalent qualifications.

Housing accommodation will be available in due course in an appropriate case.

Applications giving full details of experience and the names of two referees to be sent to the Chief Administrative Officer, Aston House, Aston, Nr. Stevenage, Herts, by Monday, 18 July, 1960. (R 343)

THE SOUTH WALES ELECTRICITY BOARD

DISTRICT COMMERCIAL ENGINEER

APPLICATIONS are invited for an appointment as District Commercial Engineer in the Pontypridd and Caerphilly District of the Cardiff and East Central Area of the Board.

The salary for the position will be in accordance with Scale 13 (£1,245/£1,410) of the Common Salary Scale of the National Joint Board Agreement for the Electricity Supply Industry.

The District territory contains the Urban District Councils of Pontypridd, Caerphilly, Bedwas and Machen, together with portions of two adjoining Rural District Councils. The area totals 58 sq. miles. Of electricity supplied to 26,000 consumers, 80% is for industry.

Prospects of development are good, both for industrial expansion in the District and for commercial and domestic expansion. The Eastern sector of the District is becoming a "dormitory" area for the influx of workers to the industrial projects at Llanwern Steelworks and an intended Car Factory at Cardiff.

The District Office is at Pontypridd and the successful candidate will be required to live reasonably close to the District office.

Applicants should preferably be Chartered Electrical Engineers.

Applications stating age, present position, present salary, qualifications and experience should be addressed to C. L. Townsend, ASSOCIATE I.E.E., Manager, Cardiff and East Central Area, 445/447 Cowbridge Rd. East, Cardiff, so as to arrive not later than Saturday, 23 July, 1960. Envelopes should be marked "District Commercial Engineer—133/60."

MECHANICAL WORKSHOP INSTRUCTOR

Applications are invited for the position of Mechanical Workshop Instructor in the Board's Apprentice Training School, Newport Rd, Cardiff.

The salary for the position will be in accordance with Grade 4 (£795/£870) or Grade 5 (£885/£960) of the National Joint Council (Administrative and Clerical Grades) Agreement for the Electricity Supply Industry, and the precise duties of the post will be decided according to the qualifications and experience of the successful applicant.

The successful applicant will be required to give instruction to apprentices in workshop practice with emphasis on the correct use of hand tools and elementary instruction on machine tools. He will also be required to lecture on related subjects.

The possession of the Ordinary National Certificate in Mechanical Engineering, or its equivalent, is desirable.

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R. G. WILLIAMS,
Secretary.
(R 319)

SOUTH EASTERN ELECTRICITY BOARD

ASSISTANT DISTRICT ENGINEER
TWICKENHAM AND RICHMOND DISTRICT

SALARY: £800/£875 per annum, plus London Allowance under N.J.B. Class F, Grade 9. Superannuable. Applicants should have had a good general education, be technically trained up to Higher National Certificate standard and must have had practical experience in general distribution work on H.V. and L.V. systems. Ability to plan and prepare schemes for mains extensions would be an advantage.

Applications, quoting ET and naming two referees on forms from District Manager, Seeboard, 42 York St, Twickenham, Middx, by 20 July, 1960.

SENIOR DEMONSTRATOR
WOKING DISTRICT

Salary within the range £700 x £25—£775 p.a. under N.J.C. Grade 2. Superannuable. Applicants should hold a recognised qualification in Domestic Science and the E.A.W. Certificate. They should be experienced in giving talks and demonstrations on all types of domestic apparatus and be prepared to work anywhere in the Woking district. The successful applicant will be required to assist in general showroom work. Applications, quoting ET and naming two referees on forms obtainable from Woking Manager, Seeboard, 4 Chobham Rd, Woking, by 20 July, 1960.

GEORGE WRAY,
Secretary.
(R 355)

CENTRAL ELECTRICITY GENERATING BOARD

South Wales Division

APPLICATIONS invited for the following superannuable N.J.B. appointments in the South Wales Division:

THIRD AND FOURTH ASSISTANT ENGINEER
SYSTEM DESIGN SECTION
TECHNICAL DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 170/ET/60.

THIRD ASSISTANT ENGINEER

Salary: AX.6, £1,090/£1,305; AX.7, £1,005/£1,215); AX.8, £925/£1,130); according to experience and qualifications.

FOURTH ASSISTANT ENGINEER

Salary: AX.11, £735/£930. Progression to a higher salary scale will be dependent on qualifications, ability and experience.

The Section is concerned with the investigation of schemes for the extension of the main transmission system in South Wales and has to deal with a wide variety of power system problems including load flow studies, fault investigations and the analysis of system behaviour. The Section has at its disposal a D.C. calculating board and an A.C. network analyser.

Candidates should have a University Degree or Higher National Certificate, and some practical experience in the supply or manufacturing industries would be an advantage.

THIRD ASSISTANT ENGINEER
EFFICIENCY, TESTING AND COMBUSTION SECTION, GENERATION DEPARTMENT
DIVISIONAL HEADQUARTERS
Vacancy No. 171/ET/60.

Salary: AX8, £925/£1,130.

The successful candidate will be required to assist in organising and conducting acceptance tests on new generating plant, routine plant tests and investigations into operational difficulties, and improving power plant performance in power stations within the South Wales Division. A knowledge of standardisation and calibration of test instruments and electronics would be an advantage.

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CENTRAL ELECTRICITY GENERATING BOARD

Midlands Division

ASSISTANT SHIFT CHARGE ENGINEER

REQUIRED at Nechells "A" and "B" Power Stations. N.J.B. service conditions, superannuable appointment, salary within, Grade K.9, Scale No. 10, £1,010/£1,130 per annum, plus 10% for shift duties.

A sound technical training and practical experience in the operation and maintenance of a modern power station are required. Appropriate technical qualification desirable. Applicants who previously applied for this position will be reconsidered and need not re-apply.

Apply quoting vacancy number 169/60MD on forms AE6, available from the Station Superintendent, Nechells Power Station, off Aston Church Rd, Nechells, Birmingham 7, to whom they should be returned when completed not later than 22 July, 1960. (R 345)

CITY OF WAKEFIELD

City Engineer's Department

APPOINTMENT OF FOREMAN ELECTRICIAN

APPLICATIONS are invited from apprentice-trained electricians for the appointment of a working foreman who will take charge of a Street Lighting and General Electrical Maintenance Section which is shortly to be set up in the Department.

Preference will be given to applicants who have had previous experience in the maintenance and installation of street lighting apparatus.

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EASTERN ELECTRICITY BOARD

APPLICATIONS are invited for the following appointments. The successful candidates will be required to contribute to a superannuation scheme and may be required to undergo a medical examination.

Norfolk Sub-Area

GREAT YARMOUTH DISTRICT

(i) THIRD ASSISTANT ENGINEER
170/60.R.

(ii) FOURTH ASSISTANT ENGINEER
171/60.R.

Candidates for (i) should have had experience in operation and maintenance of H.V. and L.V. overhead and underground systems (including substations), fault location and protection.

Candidates for (ii) should have had a sound technical training and experience in the construction, operation and maintenance of H.V. and L.V. distribution systems, including substations.

Salary: N.J.B. Class F, as follows: (i) Grade 9 V(£800/£875); (ii) Grade II (£690/£785).

Apply by letter within 14 days to the Manager, Gt. Yarmouth District, Eastern Electricity Board, Regent Rd, Gt. Yarmouth, Norfolk.

Northmet Sub-Area

THIRD ASSISTANT ENGINEERS

(a) ST. ALBANS DISTRICT (Ref. 987)
169/60.R.

(b) EDMONTON DISTRICT (Ref. 988)
172/60.R.

Candidates should have had a sound technical training and suitable experience in the construction, operation and maintenance of H.V. and L.V. distribution systems (including substations).

Salary: N.J.B. Grade 9 as follows: (a) £875) plus London Allowance.
Class G (£845/£930); (b) Class F (£800/

Apply by letter within 10 days as follows:

(a) F. J. Drake, ASSOC.I.E.E., Manager, St. Albans District, Eastern Electricity Board, 107 St. Peters St, St. Albans, Herts.

(b) C. A. Baker, B.SC.(ENG.), M.I.E.E., Manager, Edmonton District, Eastern Electricity Board, 305 Fore St, Edmonton, London N.9. (R 348)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

NORTHFLEET POWER STATION
VACANCY No. 144/60.
ASSISTANT ENGINEER (ELECTRICAL)

APPLICANTS should possess H.N.C. (Electrical) with both light and heavy current subjects. Duties will include maintenance, fault location and testing of a wide range of protection, electronics and heavy current equipment, together with supervision of general maintenance.

Salary: N.J.B. Class M, Grade 10, £1,130/£1,265 per annum, including London Allowance.

Applications giving age, details of qualifications, experience, etc., to Station Superintendent, Northfleet Power Station, Crete Hall Rd, Northfleet, Kent, to arrive by 20 July, 1960.

W. H. DUNKLEY,
Divisional Controller.
(R 320)

BRITISH STANDARDS INSTITUTION
TECHNICAL STAFF

THE B.S.I. invites applications from ELECTRICAL ENGINEERS, preferably with some experience in the design and/or testing of domestic electrical appliances, to join the staff of the Institution. This staff is responsible for the work of the Institution in the preparation of British Standards in co-operation with the various sections of industry and is required to plan and progress the work. They act as secretaries to technical committees.

Applicants should have a university degree or equivalent professional qualification in electrical engineering.

There are three grades of appointment and salaries in the top grade range up to £2,000 plus; applications are invited for the grade which has at present a maximum salary of £1,250, the starting salary being dependent on individual qualifications and experience. The posts are pensionable.

Apply to the Establishment Officer, B.S.I., 2 Park St, London W.1. (R 353)

CENTRAL ELECTRICITY GENERATING BOARD
South Western Division

ASSISTANT ENGINEERS (OPERATION)
REQUIRED AT HINKLEY POINT NUCLEAR POWER STATION

SUPERANNUATION Scheme. Salary: N.J.B., provisionally within Scale 11, £1,080/£1,215 per annum.

Following a short period of theoretical training, successful candidates will, initially, be employed on certain aspects of plant inspection and will ultimately be responsible for the operation, on shift, of a reactor and its associated generating plant. Please quote Ref. ET.86/60.

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 20 July, 1960.

ASSISTANT ENGINEER (OPERATION)
REQUIRED AT BERKELEY POWER STATION
BERKELEY, GLOUCESTERSHIRE

Superannuation Scheme. Salary: N.J.B., Class M, Grade 8, Scale 13, £1,245/£1,410 per annum.

Candidates should be Corporate Members of the Institution of Electrical Engineers and/or the Institution of Mechanical Engineers or hold equivalent qualifications, and must have had responsible experience in the operation of modern generating plants. Preference will be given to candidates having experience of plant testing.

The successful candidate will be responsible to the Operation Superintendent for testing and efficiency control of nuclear and conventional plant. Nuclear knowledge will be considered an advantage but is not essential as special training will be given to a suitable candidate to fit him for employment in a Nuclear Power Station. Please quote Ref. ET.84/60.

Applications on Form AE6/ACT obtainable from the Divisional Secretary, 26 Oakfield Rd, Bristol 8, should be completed and returned by 20 July, 1960. (R 352)

CENTRAL ELECTRICITY GENERATING BOARD
South Eastern Division

KINGSTON POWER STATION
VACANCY No. 149/60.
GENERAL ASSISTANT ENGINEER (CONTROL)

EXPERIENCE of modern turbo-alternator plant is desirable and the possession of an Ordinary National Certificate in Engineering will be an advantage.

Salary: Class G, Grade 13, £770/£855 per annum, inclusive of Shift Allowance and London Allowance.

Applications in writing, giving details of education, age, present position, etc., should be sent to the Station Superintendent, Kingston Power Station, Down Hall Rd, Kingston upon Thames, Surrey, to arrive by 20 July, 1960 (R 346)

CENTRAL ELECTRICITY GENERATING BOARD
Midlands Division

APPLICATIONS are invited for the appointment of MAINTENANCE ENGINEER (ELECTRICAL) at Rugeley Power Station.

The successful applicant would be directly responsible to the Maintenance Superintendent for all electrical maintenance on the Station.

Candidates should have had experience in the maintenance of modern power station electrical equipment, and experience with hydrogen cooled alternators is desirable.

Supervisory experience and good organising ability is essential, and possession of technical qualifications to the standard of H.N.C. Elect. would be an advantage.

Salary to be in accordance with N.J.B. Schedule A, Grade 6, Class L, £1,340/£1,515.

Apply, quoting vacancy number 165/60MD on form AE6, available from the Station Superintendent, Rugeley Power Station, Rugeley, Staffs, to whom they should be returned not later than 22 July, 1960. (R 327)

THE EAST MIDLANDS ELECTRICITY BOARD

APPLICATIONS are invited from suitably qualified persons for the following appointments:

Lincolnshire Sub-Area

VACANCY No. 85/60.
THIRD ASSISTANT DISTRICT ENGINEER
BOSTON DISTRICT

Salary: N.J.B. Class F, Grade 9, Scale 6, £800/£875 per annum.

Candidates should have had practical experience of the operation and maintenance of urban and rural distribution systems up to 11 kV. The successful candidate will be required to undertake standby duties and to reside within the district.

Applications giving details of experience, etc., should be addressed to The Manager, Lincolnshire Sub-Area, North Hse, Grantham, Lincs, within 14 days of the date of this advertisement.

Northamptonshire Sub-Area

VACANCY No. 86/60.
SECOND ASSISTANT DISTRICT ENGINEER
KETTERING DISTRICT

Salary: N.J.B. Class G, Grade 7, Scale 9, £950/£1,055 per annum.

The duties include responsibility for the construction, operation and maintenance of underground and overhead systems including substations up to 11 kV. Possession of the Higher National Certificate in Electrical Engineering would be an advantage.

Ability to drive a car is essential. The successful applicant will be required to reside within the district and to undertake standby duties.

Applications giving details of experience, etc., should be addressed to The Manager, Northamptonshire Sub-Area, 25 Bridge St, Northampton, within 14 days of the date of this advertisement. (R 356)

THE BRITISH ELECTRICAL AND ALLIED MANUFACTURERS' ASSOCIATION
DOMESTIC APPLIANCES DIVISION

Applications are invited for the post of TECHNICAL ASSISTANT in the Domestic Appliances Division of the Association.

The successful candidate, aged between 25 and 35, should offer:

(a) an electrical engineering qualification up to H.N.C. standard;
(b) knowledge of the domestic electrical appliances industry;
(c) administrative experience, including the writing of reports and committee minutes;
(d) proved ability to work on his own.

The post is a progressive one with prospects of advancement to a higher grade. Initial salary will fall within the range of £750/£1,100 depending on qualifications and experience. There is a contributory superannuation scheme.

Applications should be addressed to the Secretary, B.E.A.M.A., 36 Kingsway, London W.C.2.

(R 360)

ARMATURE WINDER REQUIRED. S.E. London Repair Shop. Unfurnished flat available. Only those with wide knowledge of AC/DC up to several hundred H.P. and Repair Shop experience need apply.—Eaton Electrical Co. (Woolwich) Ltd., Lakedale Rd, Plumstead, S.E.18. (R 361)

BRITISH RAILWAYS (SOUTHERN REGION) require ELECTRICAL ENGINEERING TECHNICAL ASSISTANTS in the London Area for work connected with power supply and distribution. Knowledge of remote supervisory control equipment; switchgear and rectifier equipment, and/or high and low voltage cables and/or overhead lines will be of particular advantage.

Applicants should have had a sound technical training, having reached Higher National Certificate standard in Electrical Engineering or equivalent.

Salary range: £875 p.a. to £948 p.a.

Application forms may be obtained from the Chief Mechanical and Electrical Engineer, British Railways, Southern Region, 15 St. Thomas St, London Bridge, S.E.1. (R 339)

"STEIN & ATKINSON LIMITED"
ELECTRICAL ENGINEER

Junior Assistant required in Electrical Department of Industrial Furnace Builders.

The work will include assisting in the preparation of control scheme, etc., for the electrical equipment associated with gas, oil and electrically heated furnaces, mainly in the iron and steel industry, also the supervision of installation and commissioning. Applicants should be familiar with both a.c. and d.c. machines and control gear.

Contributory pension scheme, free life assurance and five-day week.

Applicants, preferably H.N.C. standard, should give full details of age and experience, and state salary expectations to the Personnel Manager, Stein and Atkinson Ltd., Westminster Hse, Kew Rd, Richmond, Surrey.

(R 362)

EAPL

MAINS ENGINEERS

required for

KENYA COLONY

SENIOR MAINS ENGINEERS

Experienced in the design, construction, control, maintenance and operation of extensive networks (O.H. up to 66 kV, U.G. up to 33 kV) including Substation layouts, network calculations, etc. Successful candidate will be expected to negotiate with consumers and handle European, Asian and African staff and prepare specifications and estimates of distribution schemes. Preference given to candidate of A.M.I.E.E. standard with supply industry experience. (Minimum age 30.)

MAINS ENGINEER

Conversant with construction, maintenance and operation of distribution neworks, including surveying, profiling and estimating. Experience in Street Lighting erection and house wiring problems an advantage. Must be able to handle Asian and African staff. Preference given to H.N.C. (Elec.Eng.) candidate. (Minimum age 28.)

MAINS ASSISTANT

Knowledge of electrical engineering generally and possessing at least O.N.C. (Elec.Eng.) with experience in estimating, planning and erection of service lines. Duties will include climbing and inspecting O/H lines (age 21-25).

The above vacancies offer progressive and permanent positions with initial emoluments, depending on age, qualifications and experience, in the following ranges:

Senior Mains Engineers	...	...	**£1,500 to £1,820**
Mains Engineers	...	...	**£1,320 to £1,500**
Mains Assistant	...	...	**£930 to £1,050**

*** Free furnished housing and passages. * Contributory Pension Scheme.**
*** Generous family medical benefits. * Children's Education Allowance.**
*** Free Life Assurance and Widows' Pension Fund.**

Apply in strict confidence, stating age, qualifications, experience, present position and salary to :

The London Secretary,

THE EAST AFRICAN POWER & LIGHTING CO., LTD.,

Bow Bells House, Bread Street (Cheapside), London, E.C.4.

(R 334)

CABLE ESTIMATORS required by Hackbridge Cable Co. Ltd., Hackbridge, Surrey. Must be fully conversant with estimating for Paper, Rubber and Thermoplastic Cables. Pensionable post. Write stating age, experience and salary required. For the attention of the Sales Manager. (R 305)

OVERSEAS CONTRACTS ENGINEER

A vacancy exists for an experienced Electrical Engineer to take charge of installation and commissioning of Cables, Overhead Lines, Switchgear and Transformers with associated administrative work. Previous experience essential. The work would be located in Nigeria and Ghana, the initial period of this tour being 18 months. Applications giving full particulars of age, training and experience to Employment Manager, JOHNSON AND PHILLIPS LTD., Victoria Way, Charlton, S.E.7.

(R 216)

CROMPTON PARKINSON (CHELMSFORD) LTD. invite applications for appointments in the Machine Department, Estimating Section, at their Chelmsford Works. Applicants should have had a sound technical training and some experience in handling enquiries for a.c. and d.c. rotating plant and control gear up to 1,500 h.p./kW capacity. Congenial working conditions with excellent opportunities for advancement. Five-day week. Superannuation scheme. Apply in confidence stating age, whether married or single, with details of experience and training to Personnel Officer, Crompton Parkinson (Chelmsford) Ltd., Chelmsford.

(R 264)

ELECTRICAL ENGINEER required for Glasgow office staff, age 23-28. Applicants (H.N.C. minimum) should have had experience in the manufacture of electrical machines. Progressive salary with non-contributory pension. Applications stating age, nationality, qualifications and experience to British Engine Boiler and Electrical Insurance Co. Ltd., 98 West George St, Glasgow C.2. (R 340)

CENTRAL ELECTRICITY GENERATING BOARD

CLARENCE DOCK POWER STATION, LIVERPOOL

DEVELOPMENT AND PLANNING ENGINEER

(Vacancy No. E.117/329/T)

Applications are invited from ENGINEERS of Higher National Certificate standard. The duties include long-term planning of electrical and mechanical maintenance and of plant operation. Special investigations and frequent review of methods of work. Continuous appraisal of technical and financial operating results with particular attention being paid to any deviation from standard. Salary scale: £1,340/£1,515 (N.J.B. K.5).

ALSO

SHIFT CHARGE ENGINEER

(Vacancy No. E.117/330/T)

Applicants should possess H.N.C. in mechanical and/or electrical engineering and should have had experience in the operation of high merit plant. Salary scale: £1,155/£1,305 plus 10% shift allowance (N.J.B. K.7).

Good pension, holiday and sick pay schemes.

Applications stating age, experience (and for Vacancy No. E.117/329/T names of two referees) should be sent to the Director of Labour and Welfare, Central Electricity House, 825 Wilmslow Rd, Manchester 20, by 11 July, 1960. (R 335)

ELECTRICAL ENGINEER with wide experience of estimating and supervision on big industrial and commercial installations required by large electrical contracting company in Manchester. Apply giving full details of training, qualifications, experience and salary expected to Box No. 8923, Electrical Times. (R 364)

UNITED KINGDOM ATOMIC ENERGY AUTHORITY PRODUCTION GROUP

require a

FUEL LIAISON ENGINEER

for the Sales Department, Commercial Directorate, to be responsible to a Fuel Contracts Engineer for liaison duties in connection with the administration of fuel supply contracts for nuclear power stations. Although the post is located at Risley, nr. Warrington, the successful candidate must be prepared to spend an appreciable amount of time at nuclear power station sites.

Applicants must have served a recognised engineering apprenticeship and be corporate members of a Senior Engineering Institution, or hold equivalent qualifications in the Mechanical or Electrical Engineering field. Extensive experience in a large works organisation, preferably associated with some aspect of conventional fuel supply, is also required.

SALARY: £1,370/£1,825 p.a. according to qualifications and experience.

Contributory Superannuation. Staff Housing Scheme.

Send postcard for application form, quoting ref. P.141R/J8, to Staff Officer, United Kingdom Atomic Energy Authority, Production Group Headquarters, Risley, Warrington, Lancashire. Closing date: 25 July, 1960.

(R 321)

G·K·N **THE GUEST KEEN AND NETTLEFOLDS GROUP OF COMPANIES WISH TO MAKE THE FOLLOWING APPOINTMENT AT THEIR GROUP RESEARCH LABORATORY.**

ELECTRICAL ENGINEER

The Group Research Laboratory at Wolverhampton requires Electrical Engineers to design and develop equipment for the control of automatic processes. This work will involve circuit design, instrumentation and the production of prototype equipment. There are vacancies for:

1. A graduate engineer who is a qualified electrical or electronic engineer. He should have experience in modern electronic techniques, including the use of semi-conductors. Preferred age 25-30. (Ref. EE/1.)
2. An electrical engineer who is qualified to H.N.C. or equivalent standard, with considerable industrial experience. (Ref. EE/2.)

Appropriately qualified men are invited to write quoting reference number and giving details of age, qualifications, present salary and career to date to:

The Recruitment Officer,
G.K.N. Group Research Laboratory,
Birmingham New Rd,
Lanesfield, Wolverhampton.

(R 322)

EXCELLENT opportunity for TRANSFORMER DESIGNER in BOMBAY. Preferably single man aged between 35-45 years, having degree in Electrical Engineering from recognised University or equivalent diploma. Good physique, strong personality, able to deal with and influence Government officials and engineers at top level. At least 5-8 years' experience with leading electrical manufacturer in design and production dealing with power transformers up to 10,000 kVA at 136 kV. Able to design independently and improve existing designs in line with best modern practice. Production organising ability. Good salary and prospects with service agreement to suitable applicant.—Write Box No. 7921, Electrical Times. (R 363)

ENGINEERING Consultants require ELECTRICAL CONTRACT DESIGN ENGINEERS for Head Office appointment. Applicants age 25-38 should be Graduate or Associate Members I.E.E., with particular knowledge of large industrial installations and extensive wiring and lighting contract work. Also experience in preparation of specifications and design of internal lighting, wiring and cabling installations in large buildings. Salary offered up to £1,200 p.a., depending on qualifications and experience.

Applications in writing to Personnel Officer, Ewbank and Partners Ltd., 10-11 Grosvenor Pl, S.W.1. (R 323)

ESTIMATING/SALES ENGINEER required. Applicants must have had experience of preparing tenders for Diesel Engine Generator sets up to 200 kVA. Good salary and excellent prospects—Hampson Industries Ltd., West Bromwich. (R 341)

JOINTER AND SWITCHGEAR ERECTOR required for East Africa, H.T. and L.T. underground cables.—Apply Box No. 7927, Electrical Times. (R 370)

QUALIFIED TECHNICAL ASSISTANT, 22-25 years of age, with H.N.C. Electrical and preferably some experience of motors and switchgear. Required in Sales Office of small progressive manufacturers in Home Counties to assist in handling orders for specialised equipment used in electricity generation, distribution and industry at home and overseas. High salary for outstanding ability. Reply Box No. 7917, Electrical Times. (R 270)

REPRESENTATIVE required by substantial electrical contractors to call on Consultants, Architects, Councils, Builders, etc., in Eastern Counties to secure enquiries. Outstanding opportunity for hard-working young man of good appearance and pleasing personality with knowledge of electrical installation work, seeking progress. Opportunity of ultimate directorship. Apply stating age and past experience.—Box 7925, Electrical Times. (R 369)

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(2) **DEVELOPMENT ENGINEER.**

(3) **SALES ENGINEERS.**

(4) **REFRIGERATION, MECHANICAL AND HYDRAULIC DRAUGHTSMEN AND ESTIMATORS.**

Five-day week. Contributory pension scheme. Applications, which will be treated in strict confidence, should be made in writing stating age, experience, salary required, etc., to Managing Director, Denco Works, Hereford.

(R 20)

ASSISTANT ELECTRICAL ENGINEERS

Senior and Intermediate Grades are invited to apply for vacancies in an expanding department of Consulting Engineers London Office, for work on industrial and commercial projects comprising the design, specification and estimates for power distribution schemes, electrical installations within buildings—heating, lighting and power.

Applicants should have served an apprenticeship or equivalent practical training together with experience in this work and must hold National Certificate or equal qualifications.

Applicants should send in confidence, education, training, age and experience to:—

FREDERICK S. SNOW & PARTNERS
Electrical Section
144 Southwark Street
LONDON, S.E.1

(R 303)

SPECIFICATION WRITER/ENGINEER. A vacancy exists with Sangamo Weston Ltd., at Enfield, for a Young Man having a light electrical engineering background and preferably educated to H.N.C. standard although candidates having an O.N.C. and continuing their studies will be considered. Work entails preparation of specifications of electrical measuring instruments to meet customers' requirements and liaison between development laboratories and contracts department. Write giving full details of experience, etc., to the Personnel Manager, Sangamo Weston Ltd., Cambridge Rd, Enfield, Middx. (R 200)

SENIOR OVERHEAD LINE ENGINEER having experience in design, planning and construction of overhead lines, both lattice steel tower and pole type, up to 132 kV. Must be prepared to work both at home and abroad and should have minimum qualification of A.M.I.E.E. or equivalent. Age 35-45. Position is pensionable. Apply giving full details of qualifications and experience to Personnel Officer, Ewbank and Partners Ltd., Engineering Consultants, 10-11 Grosvenor Pl, S.W.1. (R 324)

TRANSFORMER DESIGNER for: transformers and L.F. Chokes. (a) Laminated and C core pattern up to 5 kVA; (b) Power Transformers up to 500 kVA. Salary according to age and experience. Five-day week. Contributory Pension Scheme. Apply: Willesden Transformer Co. Ltd., Manor Park Rd, N.W.10. ELGar 5445. (R 13)

TENBY ELECTRICAL ACCESSORIES require a REPRESENTATIVE for London. Technical knowledge and good connection with Wholesale and Area Boards. Salary, commission, car, etc.—S. O. Bowker Ltd., 19/21 Warstone La, Birmingham 18. (R 358)

SENIOR INSTRUMENT TRANSFORMER DESIGNER

required by

SMITH HOBSON LIMITED

Salary: £1,000 per annum upwards, according to age, experience and qualifications.

Apply:—

Chief Designer,
SMITH HOBSON, LIMITED
WALTON-ON-THAMES

(R 371)

TRANSFORMER REPRESENTATIVE for the Electronic and Industrial Transformer fields. Preference will be given to a person already engaged in a similar capacity. Salary plus commission. Car will be supplied.—Willesden Transformer Co. Ltd., Manor Park Rd, N.W.10. ELGar 5445. (R 14)

PYROTENAX LIMITED

Require ELECTRICAL DRAUGHTSMAN for interesting work associated with space heating. Experience of cable layout work desirable. Apply giving details of experience and qualifications to the Contracts Manager, Pyrotenax Ltd., Hedgeley Rd, Hebburn, Co. Durham. (R 357)

WANTED

WANTED for prompt cash, ferrous and non-ferrous SCRAP; also plant for dismantling. Buyers of second-hand machinery and plant for re-use.—W. and H. Cooper Ltd., 17 Brady St, Bethnal Green, E.1. (R 1)

WORK WANTED

A.C. and D.C. MOTOR REWINDS and REPAIRS. Prompt service, fully guaranteed. Edgware 5566 (4 lines). — Service Electric Co. Ltd., Stanmore, Middx. (R 2)

ELECTRICAL — Electronic — Control Panels and Units. Trade inquiries invited.—Morris Electric Ltd., Mfg. Electrical Engineers, Heathmill Wks, Birmingham 9. (R 220)

LIGHT CONTROL WORK, small old-established firm invites inquiries for similar sub-contract work, assembly, coil-winding, glass-blowing, annealing, vacuum-pumping capacities.—Sordoviso Switchgear Ltd., Loughborough. (R 18)

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AT 17 MAZE POND, ST. THOMAS STREET LONDON, S.E.1
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11 o'clock, sharp
LARGE STOCK OF AN ELECTRICAL CONTRACTOR
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Pyro, T.R.S. and V.I.R. cables; 9,000 ft screwed, oval, flexible and Gilflex conduit; large quantities ¾ in. to 1¼ in. insp. fittings; brass parts; 400 pieces I.C. switch and fusegear, T.P. and N. and S.P. and N. by Bill, MEM, EE, etc.; trunking; busbars; I.C. gang switches; H.R.C. fuses; 140 MEM and Crabtree starters; W/T fittings; tube heaters, etc.

1,100 switch sockets by Crabtree; switches; holders; roses; blocks; plugs; lamps; and bakelite accessories of all descriptions; 5,500 TOK rotary switches; meggers, etc. On view day prior and day of Sale.

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'Phones: HOP 1212/3. 'Grams: Loudsigs, London. (R 359)

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A.A. ELECTRICAL CO. for A.C.-D.C. MOTORS, switchgear, exhaust fans, hoists, reduction gears, new or reconditioned units.—Chi 5105, 67 Rothschild Rd, W.4. (R 3)

ELECTRIC MOTORS, D.C. and A.C. Motor Generator Sets, Alternators and Dynamos, Diesel Sets, Circuit-breakers, Switchboards, reconditioned and guaranteed. Very large stocks held.—Britannia Manufacturing Co. Ltd., Britannia Walk, N.1. CLErkenwell 5512-3-4, Stores at Chobham, Surrey. (R 7)

HOUSE-SERVICE METERS, A.C. or D.C., quarterly or prepayment.—Universal Electrical, 221 City Rd, London, E.C.1. (R 5)

HOUSE-SERVICE METERS, all types can be obtained by return from Selectrics, Dept. E.T., Meter Hse, Factory Row, Castle Circus, Torquay. Phone 7218. (R 8)

FOR Sale: Two Metropolitan-Vickers Electrical Co. Ltd. Ripplay CENTRALISED CONTROL INJECTION EQUIPMENTS equipped for up to 12 signal channels and at present injecting in parallel into a 6·6 kV system at a frequency of 790 c/s. Can be arranged for either local or remote control. This equipment, which is in sound working order, can be inspected in Huddersfield on application to the Manager, No. 2 (Huddersfield) Sub-Area, Yorkshire Electricity Board, Market St, Huddersfield. (R 329)

PURLEY CHOKES AND BALLASTS. Our 80-W tapped h.p.f. ballast with starter switchgear-holder incorporated is proving itself the most popular unit. Suitable for most fittings, 57s 6d each subject. —F. W. Blanshard Ltd. (Dept. E.T.), Purley, Surrey. Uplands 4818/9. (R 6)

SECOND-HAND Electrical Plant can be as good as new if you buy it from specialists. Write for our stock list. Dynamo and Motor Repairs Ltd., North End Rd, Wembley Pk, Middlesex. Telephone: Wembley 3121; Soho Rd, Handsworth, Birmingham. Telephone: Birmingham Northern 0898. (R 10)

QUANTITY of P.I.L.C.S.W.A. CABLE for sale in various sizes at trade price less 50%. Phone or write to Tree Electrical Co., 19 Half Moon La, Herne Hill, S.E.24. or Brixton 3028. (R 366)

FOR
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And
ALL Formed Wire Articles and Small Sheet Pressings
CONSULT
PARKIN WIRE PRODUCTS LTD.
Carleton Works, Ford, Sussex
Contractors to G.P.O., Electricity Boards, Etc. (R 15)

AGENCIES

AGENT required to sell Street Lighting Equipment on a commission basis in Eastern Electricity Board area.—Apply: A. C. Ford Ltd., Pear Tree La, Dudley, Worcs. (R 365)

PATENTS

THE Proprietors of British Patent No. 771,974 for "METHOD OF COMPENSATING ANGULAR TRANSMISSION CHARACTERISTICS ELECTRICALLY WITH PARTICULAR FUNCTIONAL RATIO," desire to enter into negotiations with a firm or firms for the sale of the patent or for the grant of licences thereunder. Further particulars may be obtained from Marks and Clerk, 57 and 58 Lincoln's Inn Fields, London W.C.2. (R 367)

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GUARANTEED COACHING for CITY AND GUILDS EXAMINATIONS—Electrical Engineering Practice; Electrical Installation Work and Illumination Engineering. Also many practical non-examination courses. No books to buy. Write for FREE Prospectus, stating subject, to I.C.S., Intertext Hse, Parkgate Rd (Dept. 430), London S.W.11. (R 368)

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A quick guide to trouble finding in all classes of industrial electrical equipment. Tables specially classified according to defects in plant giving causes of trouble and action required.

Tables cover a.c. motors, d.c. machines, a.c. generators, rotary converters, bearings, transformers, mercury arc rectifiers, starters and switchgear and fluorescent lighting.

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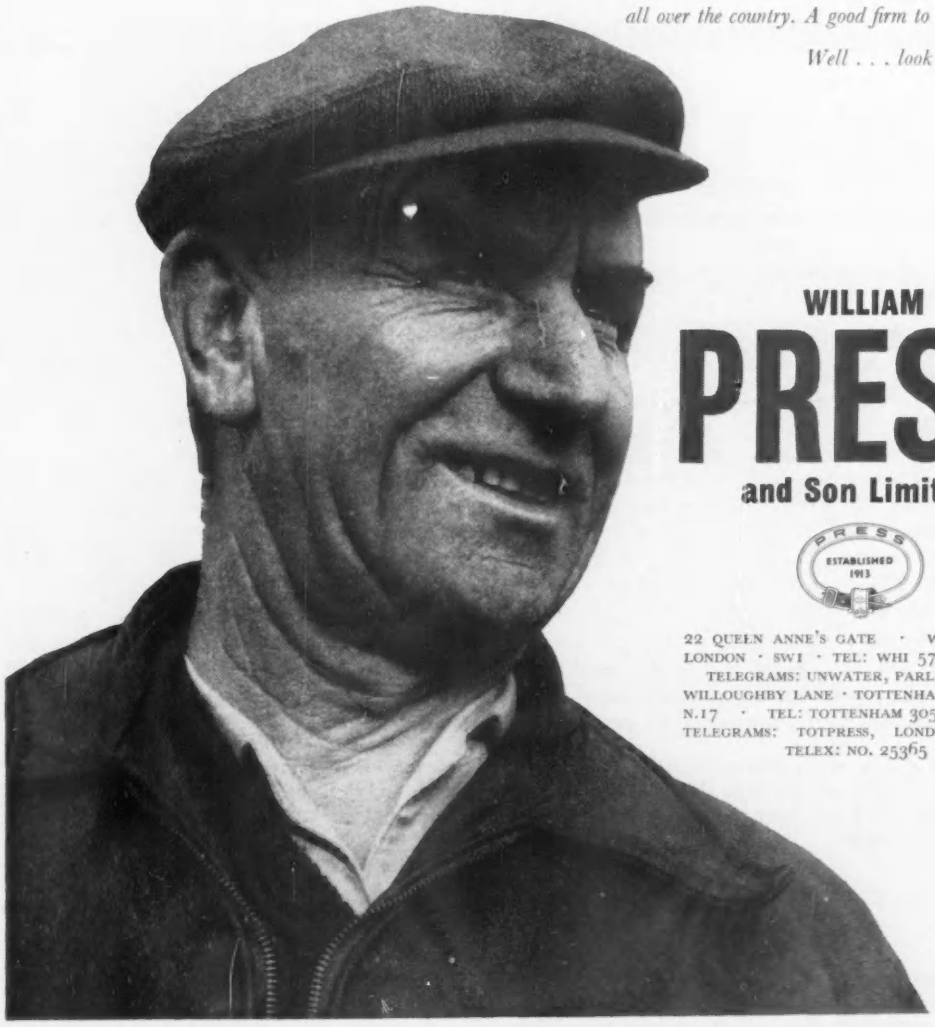

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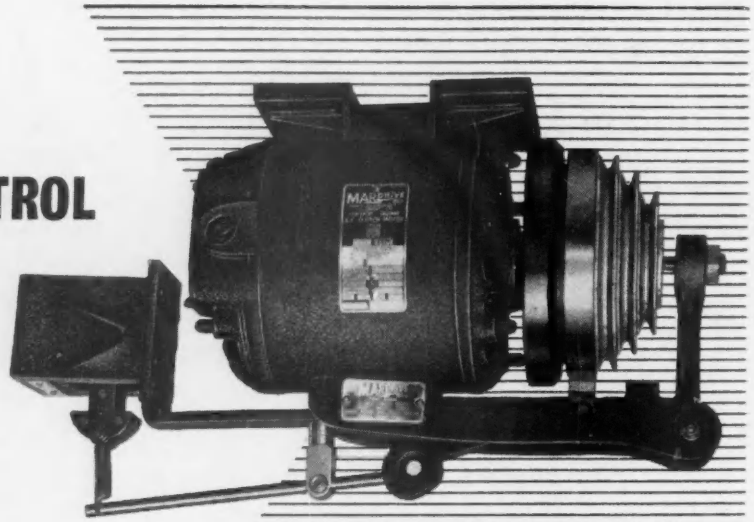

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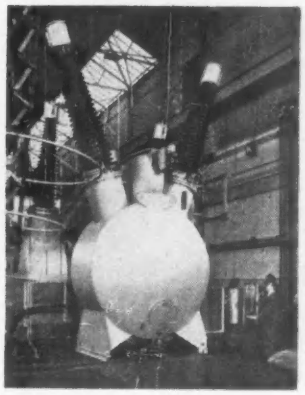

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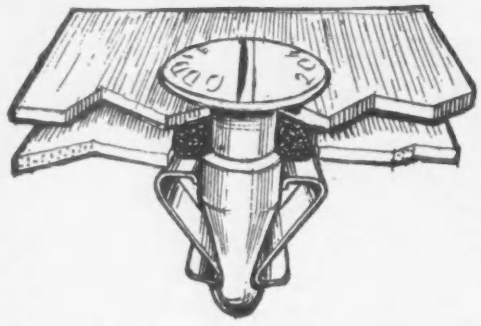

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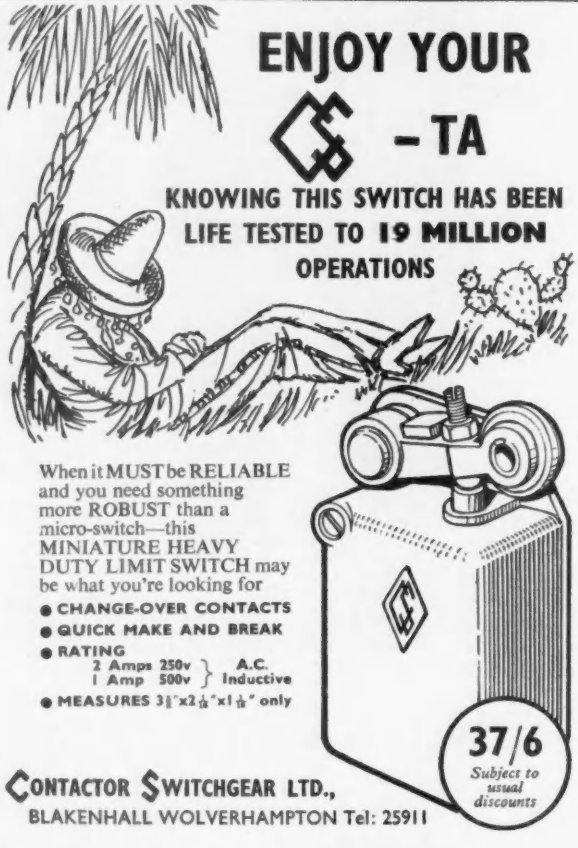

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218	10	20
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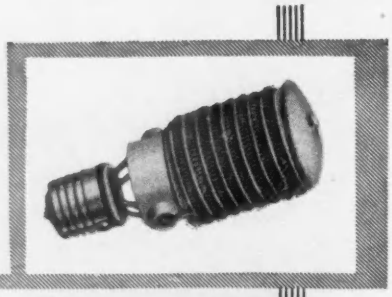

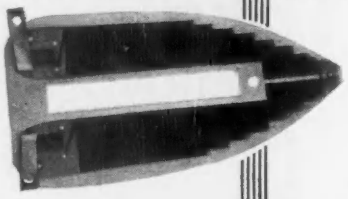

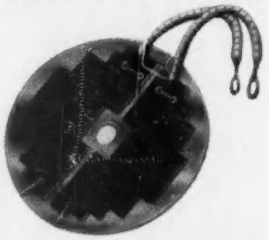

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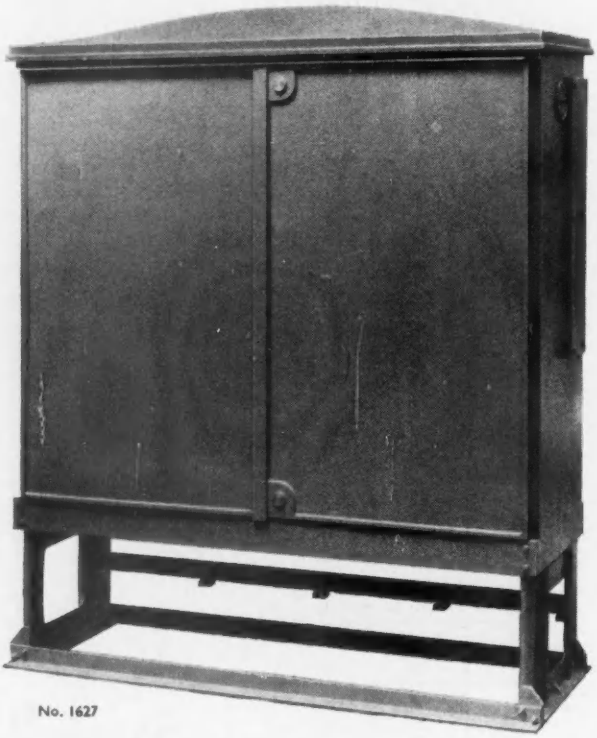

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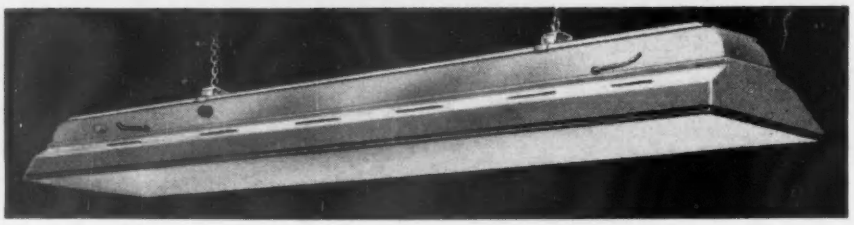

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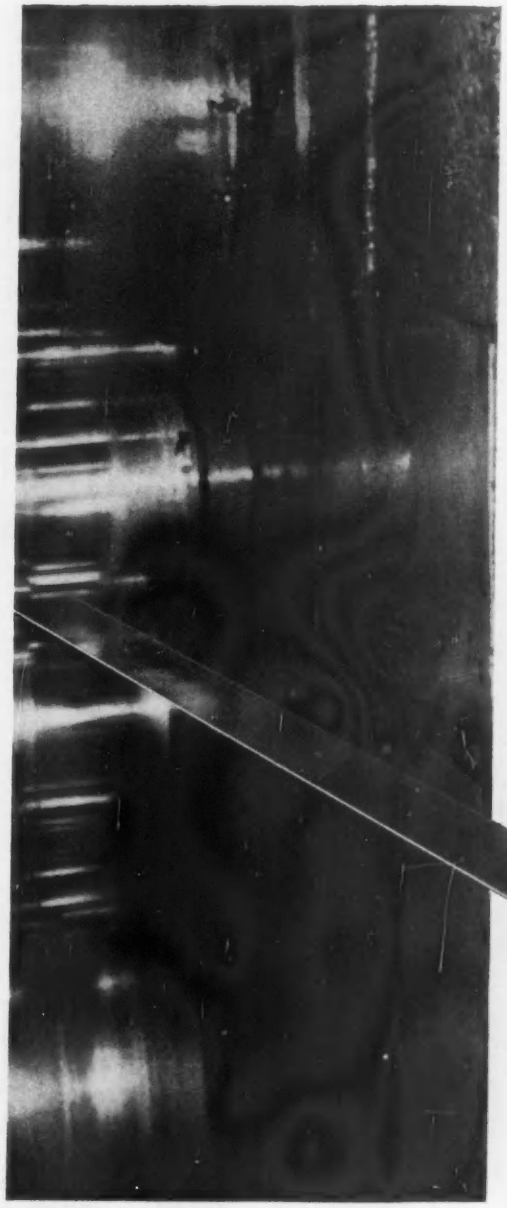

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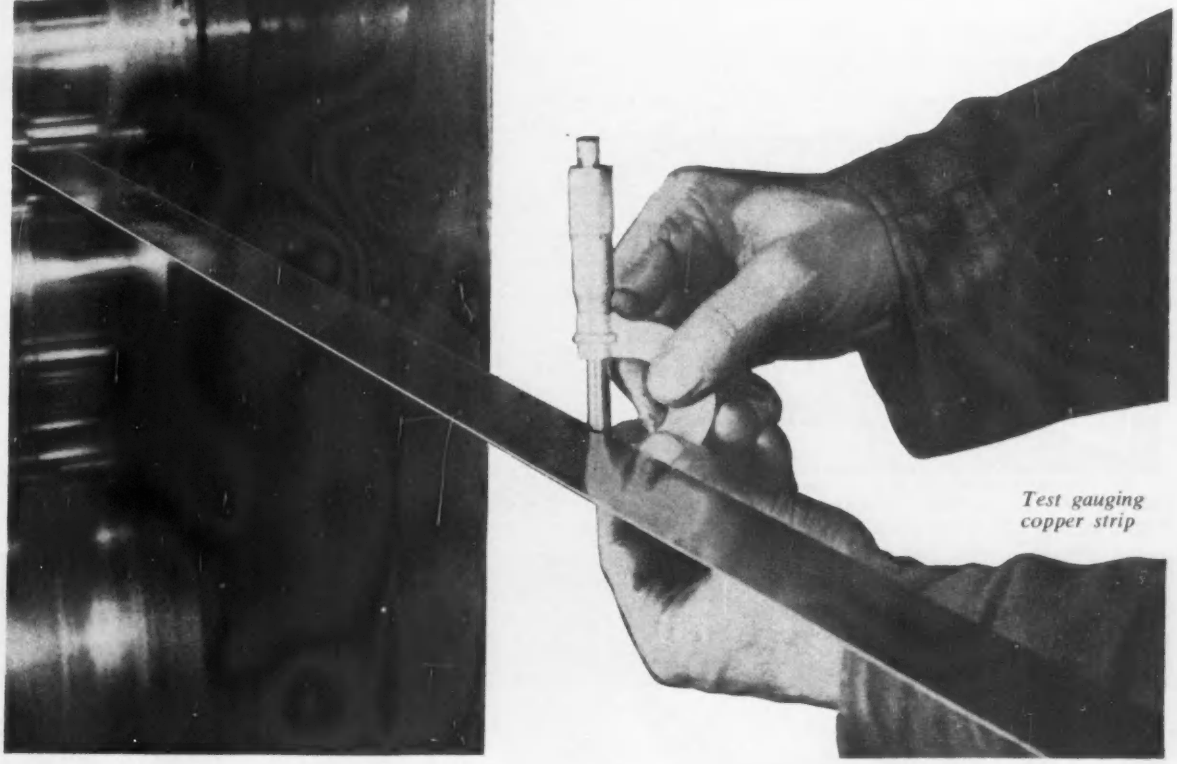

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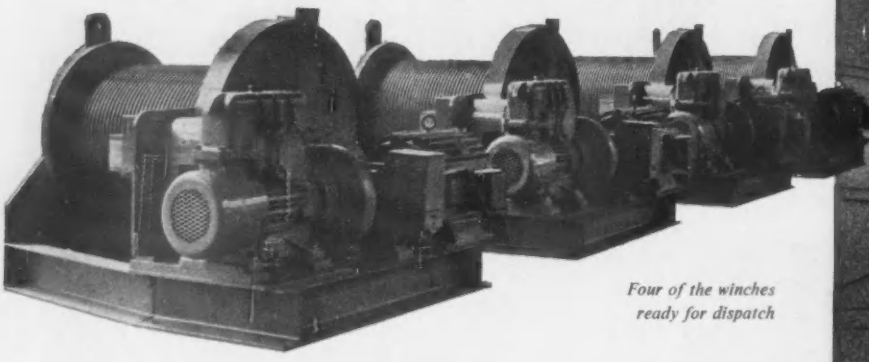

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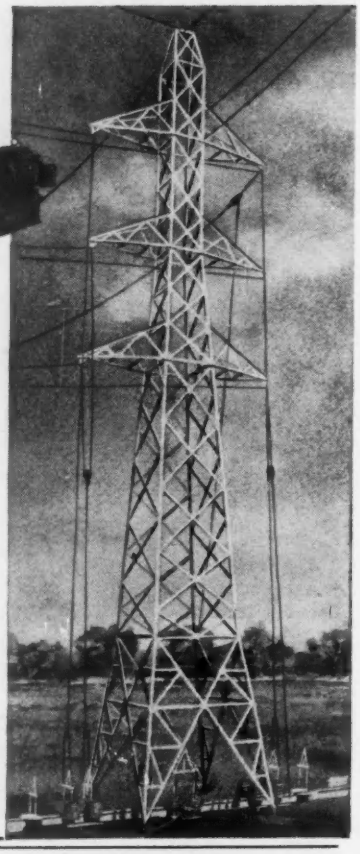

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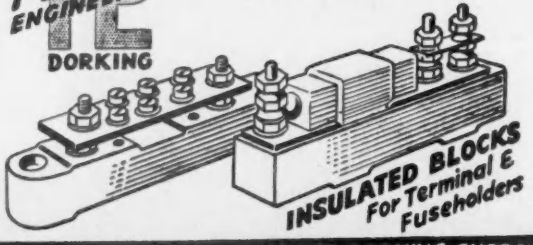

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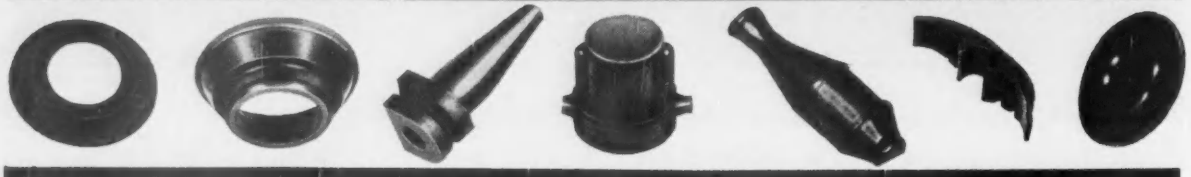

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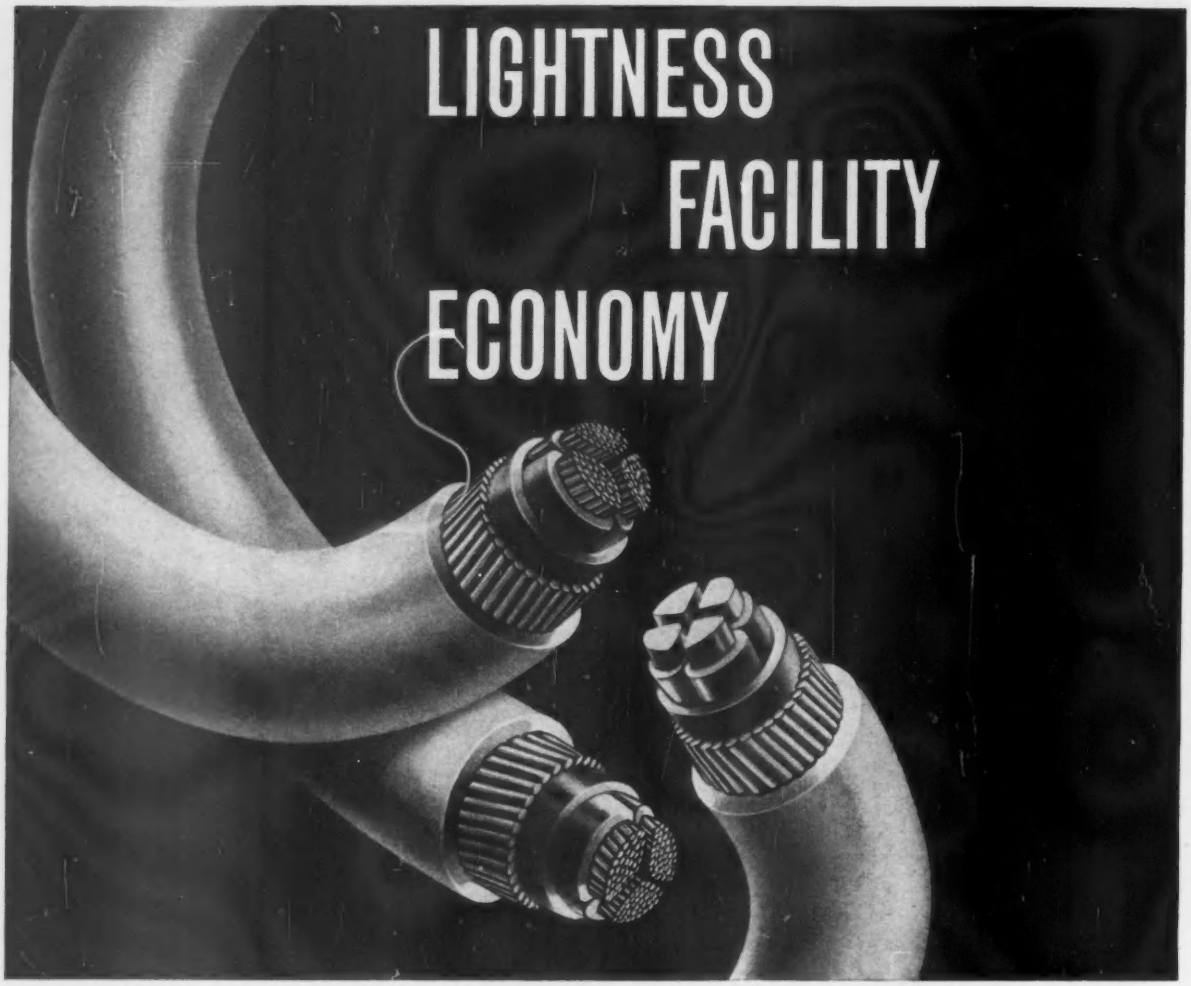

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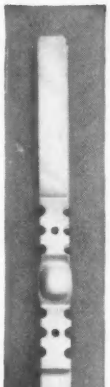
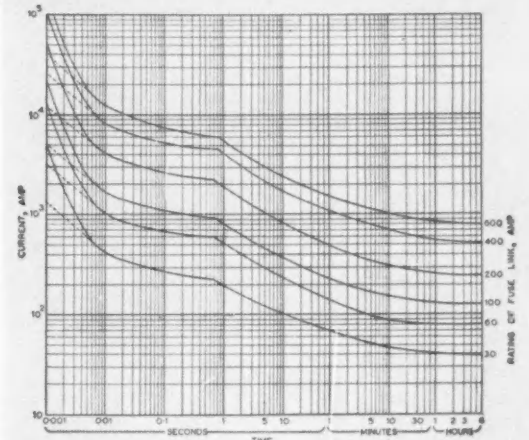


(Right) The standard type of Aeroflex fuse element.



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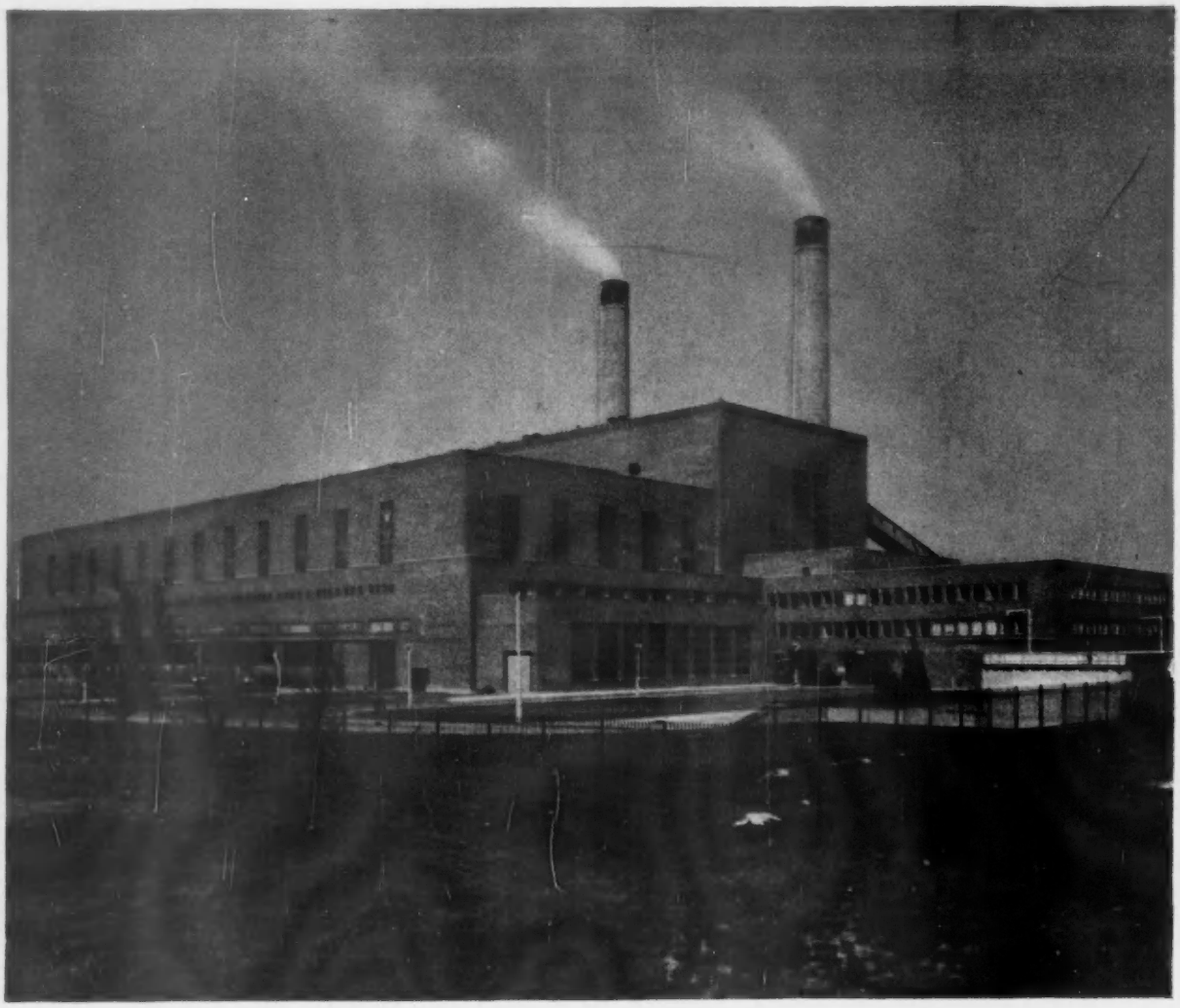

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